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Music technology in education

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NOTE TO USERS

MUSIC TECHNOLOGY IN EDUCATION

A Thesis

Presented to

The Faculty of the Department of Music

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In Partial Fulfillment

of the Requirements for the Degree

Master of Music Education

by

David Trustman

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INFORMATION TO USERS

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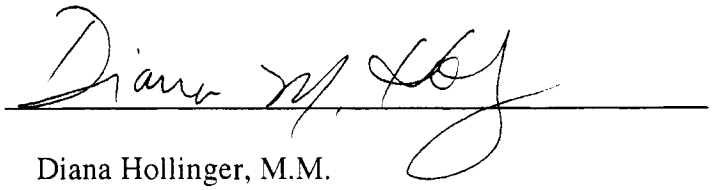

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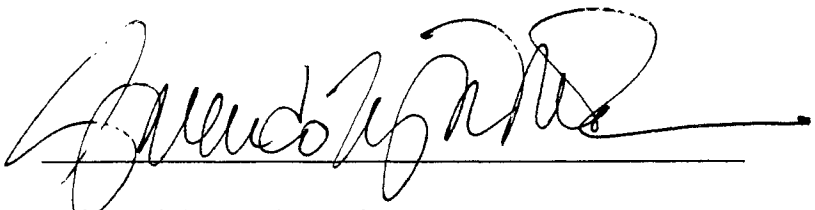

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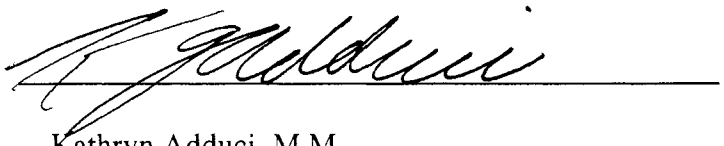

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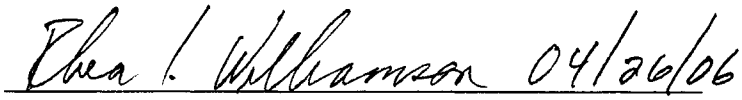

ABSTRACT

MUSIC TECHNOLOGY IN EDUCATION

by David Trustman

This thesis is designed to be the textbook for a Music Technology course. It explores the software used for the course, including music notation, MIDI and sequencing, computer aided instruction, and PowerPoint, as well as introducing the Internet and History as they pertain to music technology. This text serves as a basic manual for the various programs taught in the course, including Finale, Sibelius, Digital Performer, GarageBand, Practica Musica, and PowerPoint, giving students an opportunity to read and examine materials while working on projects. It also includes a chapter covering the history of music technology, which can be useful for students in finding information pertinent to their final projects in the class.

I would like to thank my wife, Tiffany, and my children, Elijah and Olivia,
for their support during the long process of attaining my goal of
a master's degree in music education.
Without their love and support, it would not have been possible for
me to finish. I would like to dedicate this book to them.

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Introduction

In creating this thesis, one of the first questions to address is why is a textbook necessary? By reviewing the available materials comparable to this project, it became obvious that this project was different.

The most closely related and current text was *Experiencing Music Technology*, by David Brian Williams and Peter Richard Webster. This was previously used for the course and is an excellent reference for teaching music technology. It contained useful information on most aspects of music technology, including MIDI, notation, CAI (computer aided instruction), history, and the Internet. Because the book covers all of music technology, covering a wide spectrum of programs, it serves as an excellent resource for the class, to be used as a reference.

Essentials of Music Technology, by Mark Ballora, while seemingly germane to the topic of the class, is best suited as a reference book for additional information for a student's final projects in music technology. It discusses MIDI, digital audio, computers, and digital instruments, but had no section on notation. The book looks at the broad picture of music technology and specifics of how synthesis and computers work, but did not take an in depth look at any computer programs.

Additional sources that are more specific include *Finale Power!,* by Mark Johnson, *Finale: An Easy Guide to Music Notation,* by Thomas E. Rudolph and Vincent A. Leonard, Jr., *Producing Music with Digital Performer,* by Ben Newhouse, and *Garage Band: The Missing Manual,* by David Pogue and are all excellent references. They each have a much more in depth look at each specific program and are very useful for

students, but buying multiple books to cover each program used in the music technology class would have been price prohibitive for students. These books are excellent reference books, as would each programs official manual.

Other books were examined as possible texts for this course and are listed in the annotated bibliography. These books are frequently out of date, as music technology changes rapidly or not specific enough for use in this course as a textbook.

After reviewing materials, it became clear that there is no text that fits the scope of most courses taught throughout the country. Many, however, are referenced during the course and are listed in the class syllabus as suggested reading.

This is what led to the creation of a book that could be used specifically for teaching a general music technology class. This project flows sequentially through necessary materials and explains how each program is used, allowing students to go back and read how to accomplish the tasks taught in the course. Explanations are as short as possible and use as many visual cues as necessary. The goal was to create a readable text that was simple for the student to follow and provide an extensive bibliography for student reference.

Chapter 1

Music Notation

Until the 1960's, printed music appeared in two forms, handwritten or typeset. Either was a painstaking process involving many hours of work. The birth of computers ushered in experimentation in a wide range of disciplines, including math, science, literature, and music, and in 1967, Leland Smith, a professor at Stanford University, began work on a music notation program called SCORE.[1] Though not the first foray into music notation on a computer, it is the only software created in the early world of computers that is still produced today. As with SCORE, most computers and software developed between the 1950's – 1970's were accessible only through major universities and large corporations. In the 1980's, as personal computers became more accessible, music notation programs became readily available to the general public.

The personal computer revolution brought computers into homes around the world and software developers created programs to sell to a new market of consumers. Along with SCORE (PC), Mark of the Unicorn's *Professional Composer* (Mac) and Coda's *Finale* (PC/Mac) were introduced to the general public in 1985.[2, 3] Early programs were not well received on all fronts. Since the average home-computer owner of the mid-1980's owned a dot-matrix printer, the quality of output from the programs was not as good as typeset music, showing jagged diagonal lines. Printing technology

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[1] "The SCORE Music Publishing System," <http://www.scoremus.com/score.html>.
[2] "About MOTU," <http://www.motu.com/other>
[3] David Brian Williams and Peter Richard Webster, *Experiencing Music Technology,* 2nd Ed. (Belmont, CA: Wadsworth Group/Thomson Learning, 1999), p. 324.

evolved concurrently with computer and software technology, and the average consumer can use music notation software that produces printed music of a professional quality.

What is music notation software?

Music notation software is the equivalent of a word processor for music. While Microsoft's *Word* allows a person to input text into a computer, notation software enables a user to enter music. Through the use of the computer keyboard, mouse, and MIDI instruments, musicians can quickly create professional quality notated music.[4]

There is a wide variety of music notation software available on the market today, in a price range that is equally variable. While the following list is not a complete inventory of notation programs, it is indicative of what is currently available on the market and the following list is a sample of what is available to the consumer. Prices vary greatly among the programs. Consult the manufacturer's websites for current pricing.

Encore – PC/Mac–Demo available - **http://www.gvox.com/**

Finale – Demo's available for all products - **http://www.finalemusic.com/**
Finale 2006 – PC/Mac
Finale Allegro – PC/Mac - Finale less some engraving options
Finale Guitar – PC/Mac - Basic Notation for Guitarists
Print Music – PC/Mac - Max 24 staves
Finale Songwriter – PC/Mac - Max 8 staves, Chords, Midi
Notepad Plus – PC/Mac - Max 8 staves, midi import and export
Notepad – PC/Mac – Free – Max 8 staves

Harmony Assistant/Melody Assistant – PC/Mac - Demo available – **http://www.myriad-online.com/en/index.htm**

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[4] Note: These programs are designed to produce music based on the traditions of Western music.

LilyPond – Unix based program (text input defines output – similar to HTML) -Free - **http://www.lilypond.org**

Lime – PC/Mac- Demo available – **http://www.cerlsoundgroup.org/main.html**

MagicScore – PC - Demo available - **http://www.musicaleditor.com/**

MidiNotate Composer – PC - Demo available – Basic notation program centered around converting MIDI files to notation – does allow user input of new music - **http://www.notation.com/index.htm**

Mozart – PC - Demo available - A full notation program though not as robust as Finale or Sibelius - **http://www.mozart.co.uk/**

MusicEdit – PC - Demo available – designed for guitar players- **http://www.musedit.com/**

Music Publisher – PC - Demo available - "Focused entirely on the printed page it is above all a What-You-See-Is-What-You-Get visual system. The philosophy of Music Publisher 5 is that it is simply a replacement for pencil and paper. If you want a particular effect on your score which "breaks" the rules of music then Music Publisher 5 will not argue! Above all it produces the notation *you* want to see and does not impose its own rules."[5] - **http://www.braeburn.co.uk/mp.htm**

Nightingale – Mac - Demo available - The freeware NightLight, which is also available for download, includes virtually all the features of its larger sibling (but with a limit of 4 page scores and 9 stave systems) - **http://www.ngale.com/index_02a.html**

Noteworthy Composer – PC - Demo available - Basic notation software – **http://www.noteworthysoftware.com/composer/**

Personal Composer – PC – PC44/PC16/PC8 (44 staves/16 staves/8 staves) - Demo available - **http://www.pcomposer.com/**

Score – PC - **http://www.scoremus.com/**

Sibelius – Demo's available for all products - **http://sibelius.com/**

Sibelius 4 – PC/Mac
Sibelius G7 – PC/Mac– Guitar based notation
Sibelius Student Edition – PC/Mac– Limited to 8 staves

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[5] Bernard Hill, Braeburn Music Web Site. http://www.braeburn.co.uk/mp.htm.

Songworks II – PC/Mac– **http://www.ars-nova.com/songworks.html**

It can be a daunting process to choose which piece of software best suits your needs. Since most are available in a demo form, consumers can easily download and try out the programs before purchasing.

Even with this large group of retail notation programs, the majority of musicians choose between two from the list above: Finale and Sibelius. Both are extremely comprehensive in their abilities to produce musical scores and, as the industry leaders, they will be the only programs covered in depth here.

In the lab with Finale

Creating a New Score:

Upon launching Finale 2005, the user is automatically presented with Finale's Launch Window. The simplest way to create a new score in Finale is to select the Setup Wizard (Fig. 1.1).

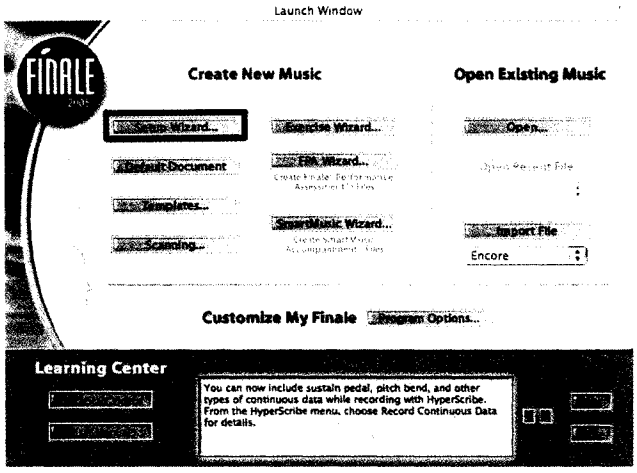

Fig. 1.1- Finale Opening Screen[6]

[6] All Finale screen shots used by permission from MAKEMUSIC, Inc.

The Title Screen will appear next (Fig. 1.2). It is easier to setup as much as possible while using the Setup Wizard, rather than adjusting each attribute later in the program.

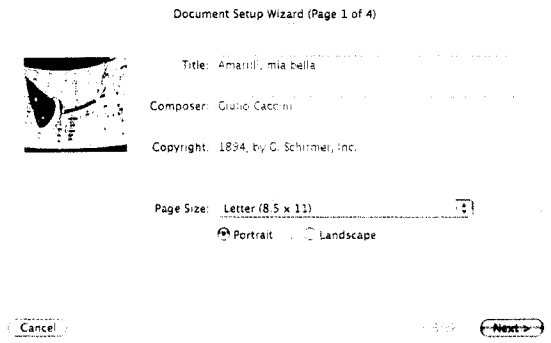

Fig. 1.2-Finale Title Setup

The instrument selection screen follows the title (Fig. 1.3). At this point, it is important to consider the layout of the score. In what order do you want the instruments to appear? In a vocal and piano score, do you want the name of the instrument on the score? The default order is listed as "Orchestral" in the lower right of the window. You may also choose Choral, Concert Band, Marching Band, Jazz Band, or Custom. The instruments are listed by family in the left window, then individual instruments in the center window. Once you have added the instruments required by using the "ADD" button, you can select any instrument in the window on the right, using the arrows to the right of the screen to move them into any order you desire.

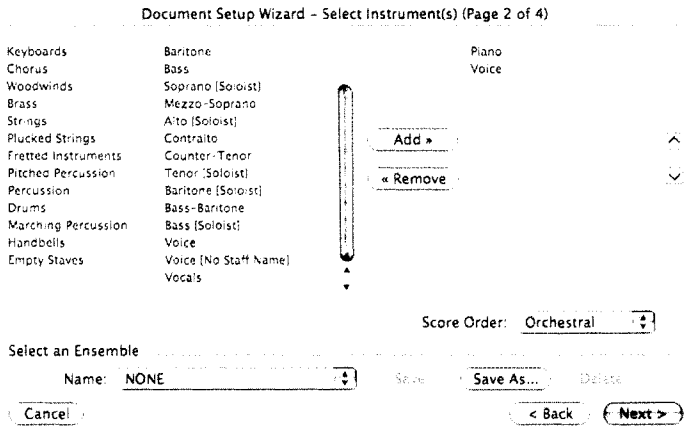

Fig. 1.3-Instrument Selection

After finishing with the instruments, you are presented with the Time Signature and Key Signature window (Fig. 1.4). You can scroll through all of the major and minor keys, as well as select from the most common time signatures. Notice that the last time signature, on the right, is two question marks. By clicking this selection you are presented with a new window in which you may create any time signature (Fig. 1.5).

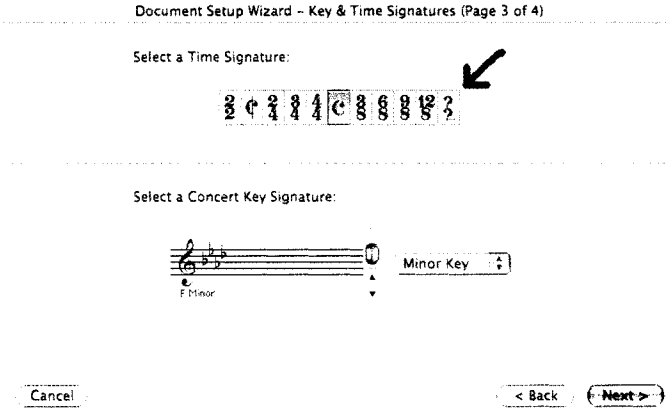

Fig. 1.4-Time Signature and Key Selection

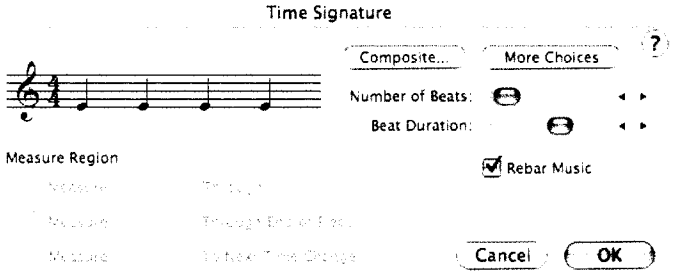

Fig. 1.5-Additional Time Signatures

The final window in the Setup Wizard includes choices for adding tempo markings and a pickup measure (anacrusis), as well as the font choice for the score (Fig. 1.6).

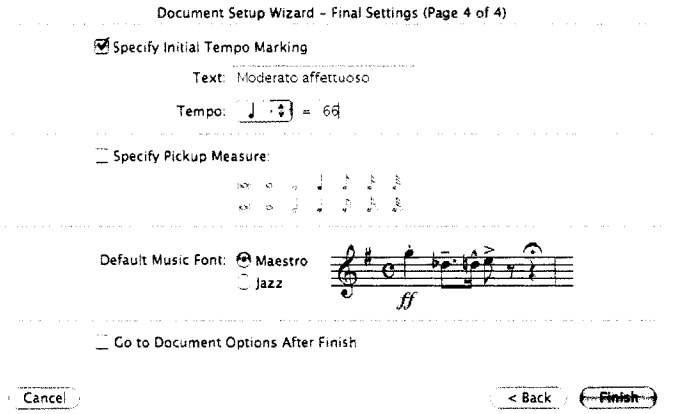

Fig. 1.6-Tempo, Pickup Measure, and Font Selection

By clicking the "Finish" button, you will be presented with a preformatted score and all of the controls to enter the music onto the page (Fig. 1.7).

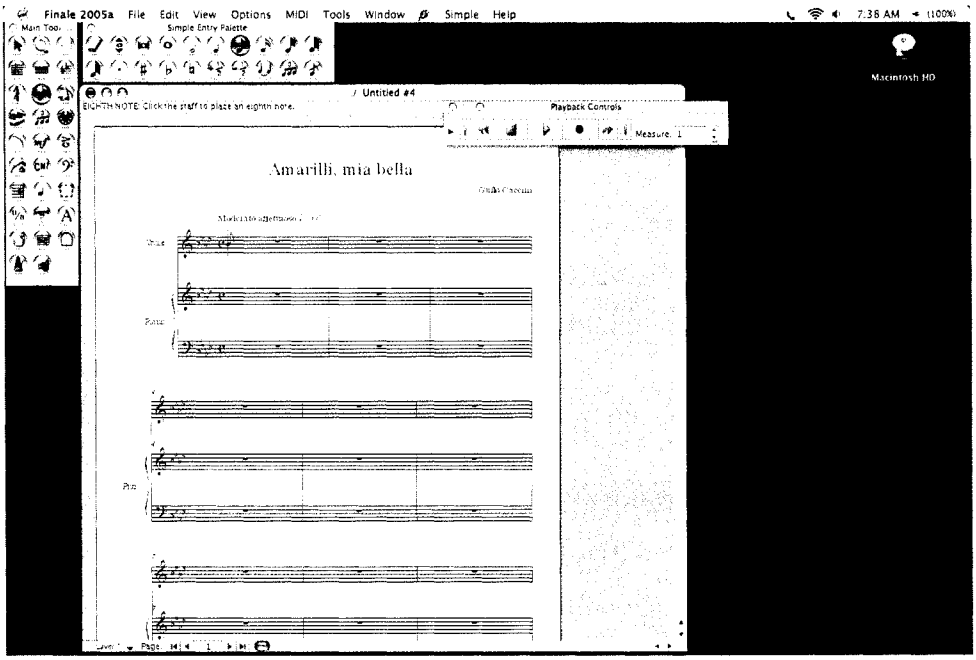

Fig. 1.7-The Finished Basic Score

You will notice three windows have appeared with the score: Main Tool Palette, Simple Entry Palette, and Playback Controls.

- One important palette is missing at this point, the Rests Palette. Click Window in the menu bar, scroll down to Simple Entry Rests Palette, and click, the rests will appear onscreen as well (Fig. 1.8).

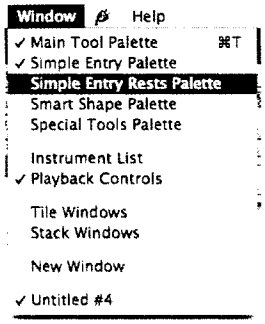

Fig. 1.8-Adding Simple Entry Rests

❖ One of the most important shortcuts to remember in Finale is Undo (⌘Z on Mac, Ctrl-Z on PC). This command makes the program step back, eliminating whatever you have just done.

Entering Notes with Simple Entry:

We will begin by entering a dotted half note into the vocal line using the Simple Entry Tool, located in the Main Tool Palette (highlighted in Fig. 1.9). Select the note value in the Simple Entry Note Palette by clicking on the half note and then the dot (Fig. 1.10a).

Fig. 1.9-The Main Tool Palette: Simple Entry Highlighted

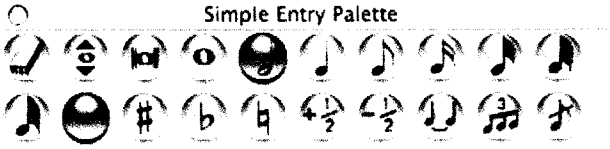

Fig. 1.10a-Simple Entry Notes Palette

You will notice that your mouse curser appears as a dotted half note (Fig. 1.10b). To enter the note on C5 (C one octave above middle C), move the cursor so that the note head sits in the desired location and click. If the note did not land on the correct note, you can use the up and down arrow keys on the keyboard to move the note. The Simple Entry Palette also includes sharp, flat, and natural buttons to change the pitch of the note.

Fig. 1.10b-Dotted Half Note Cursor on C5

Courtesy Accidentals:

When creating scores using accidentals, it is appropriate to include a courtesy accidental in front of a note when it returns to the original key.

- To add a courtesy accidental, press and hold the Option button for Mac, Alt button for PC on the keyboard. This causes the mouse cursor to change from a note to a selection arrow.
- Then click the note to which you wish to add the accidental. When selected, the note will change color from black to light blue.
- By pressing the P key on the keyboard, the courtesy accidental will appear surrounded by parentheses. Pressing the P again will remove the parentheses.

Beams:

You may find that Finale beams notes together in a grouping that is not how you wish it to appear on the page. For instance, you might enter four eighth notes and have Finale beam all four together (Fig. 1.11), when you want two sets of two eighth notes.

By Option/Alt-Clicking the third note of the group and pressing the / button on the keyboard, the beam will be broken between the selected note and the note that proceeded it (Fig. 1.12).

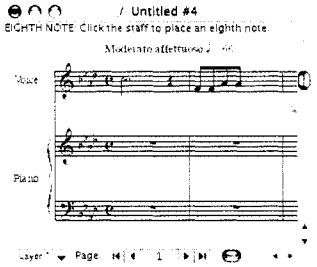

Fig. 1.11 –Note Beaming

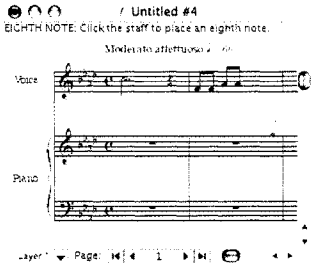

Fig. 1.12 – Splitting Beams

Having entered a few eighth notes that do not appear in the song, the next tool that becomes necessary to use is the eraser tool. The eraser is found in the upper left corner of the Simple Entry Palette (see Fig. 1.10). Simply click on the eraser button and the cursor becomes an arrow with an eraser. Just point the arrow at any note or rest and click the mouse to make the unwanted entries disappear.

Adding Dynamics & Expressions

With notes entered on a page, the score begins to develop. However, to give the music shape, it is necessary to add some dynamic markings to the music. This piece (See Appendix IV) calls for a *piano* dynamic mark over the first note.

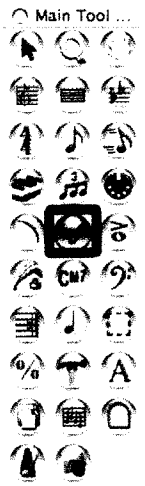

Fig. 1.13-
Expression Tool

- The user must select the Expression Tool from the Main Tool Palette (Fig. 1.13) (Note: Finale lists dynamics as expressions).
- Then double click the note at which the piano mark should appear.
- The Expression Selection window will automatically open (Fig. 1.14), allowing the user to select the p.
- By clicking the Note Expression button at the bottom of the window, the dynamic will only be applied to the selected note rather than to all the staves.
- Clicking the select button will open yet another window that allows alignment of the mark, followed by selecting the OK button to finish the process.

- The piano marking automatically appears below the note selected overlaid with a black dot, indicating that it is selected. Using the cursor, the marking can be moved above the staff, leaving room for the lyrics, which will be entered later.

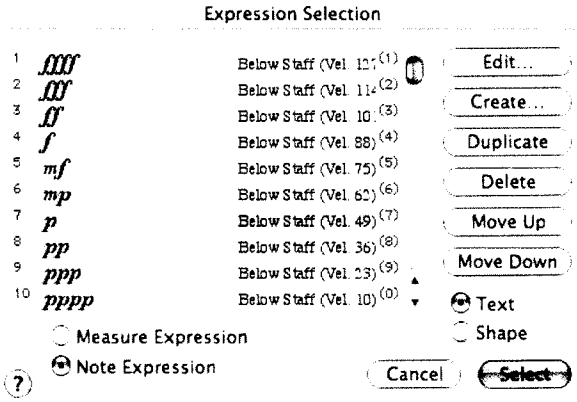

Fig. 1.14-Selecting a Dynamic Marking

Another common indicator of expression is the slur. Creating a slur in Finale is a simple process.

- After selecting the Slur Tool (Fig. 1.15) from the Main Tool Palette, the Smart Shape Palette (Fig. 1.16) appears on the screen.
- Since the slur tool is the default selection, simply double click on the starting note (making sure to hold down the mouse button on the second click), then drag the cursor to the ending note for the slur, which will become highlighted when selected.
- When the mouse button is released the slur will appear (Fig. 1.17).

Fig. 1.15-Selecting the Smart Shape Tool

Fig. 1.16-Selecting a Slur

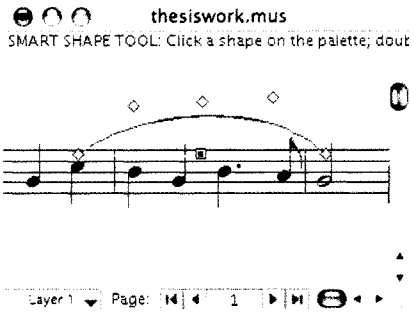

Fig. 1.17-The Slur With Adjustment Boxes

- You will notice that the slur has a series of small boxes over the length of the curve. Using the cursor, select and drag a box to change the slurs shape. The arrow keys on the computer keyboard can be used to effect small changes, moving the slur in the smallest increments possible.
- Please note, when a slur crosses from one system to the next, the default slur shape may not be desirable. In figure 18, you can see that the slur from the proceeding line is barely visible on the quarter note C. By readjusting the shape of the slur, the marking becomes much more readable (Fig. 1.19).

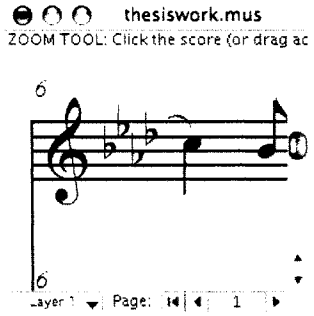

Fig. 1.18-Undesirable Slur Shape

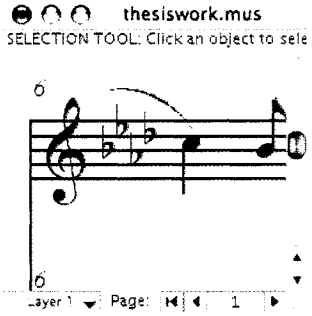

Fig. 1.19-Fixed Slur

- Finale's default shape for slurs that cross systems is a curve off the end of the line (Fig. 1.20a). In many instances this can be confusing for a musician, making it difficult to tell if the slur ends at that line or continues to the next. If the slur is reshaped to leave the first system parallel to the top staff line and enter the following system parallel as well, it is much easier to follow phrases across systems (Fig. 1.20b).

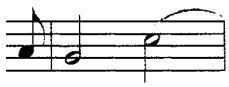

Fig. 1.20a-Default Slur

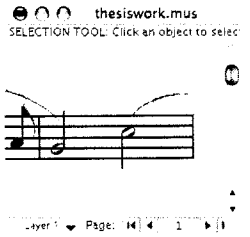

Fig. 1.20b-Fixed Slur

Other common expressions are the crescendo and decrescendo. Finale makes their input extremely simple.

- On the Smart Shape Palette (refer back to Fig. 1.16), the second row contains both the crescendo and decrescendo.
- To create a crescendo, simply select the crescendo button, double click (holding the mouse down on the second click) below the starting note for the crescendo and drag the mouse to the right.
- A crescendo will appear with a series of boxes to adjust its shape as necessary (Fig. 1.21).

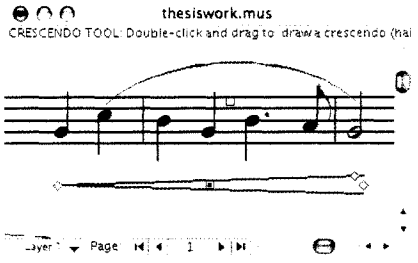

Fig. 1.21-Crescendo

Chords, Intervals, & Harmonies:

Chords, intervals, and harmonies are easy to insert using simple entry.

- Pick the equivalent note value to the previously entered note.
- Move the cursor to the desired note directly above or below the existing note, and click the mouse button.
- If the note values needed are different, perhaps a whole note against two half notes in a measure (Fig. 1.22), then the process is quite dissimilar. For this situation, Finale uses a function called Layers.

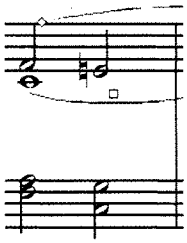

Fig. 1.22-Dissimilar Note Values

Layers are a function present in many current computer programs. They give you the ability to change or add content to a project separate from other aspects of the work. In the case of a Finale score, imagine a piece of staff paper as the bottom layer. The notes are then added to the score on transparency sheets placed on top of the staff paper. This is the basic idea behind layers. It is important to understand that each instrument in a score is a separate unit. It is unnecessary to add a layer for each instrument; layer 2 in the bassoon part will not affect layer 2 in the trumpet part. In addition, working with a piano score, the treble and bass lines are also independent, so there is no need to use one layer for bass and one for treble. If you are creating a piano score for a four part vocal

works, where each voice moves independently, it will be necessary to group the voices in two different layers (for instance, soprano and tenor in Layer 1, alto and bass in Layer 2). That puts one voice/note in the treble and bass clefs in each layer.

To work in a new layer, select the layer from the bottom left corner of the main window (Fig. 1.23a). Choosing Layer 2 will enable the user to input two notes of different values in the same place (Fig. 1.23b).

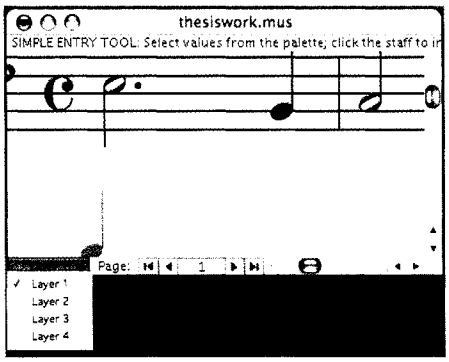

Fig. 1.23a-Changing Layers

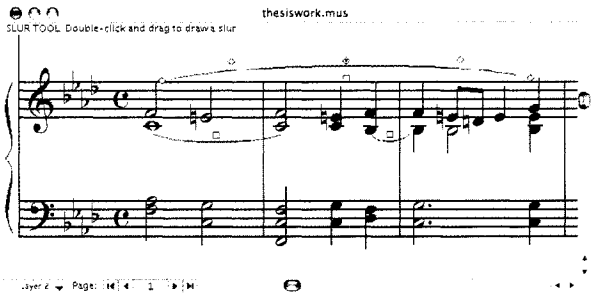

Fig. 1.23b-Different Note Values in Layer 2

Lyrics:

Now that the music has been input, it is time to input with the lyrics.

- First, it is necessary to select the Lyrics Tool from the Main Tool Palette (Fig. 1.24).
- Once the Lyrics tool is selected, simply click on the starting note to begin entering lyrics.
- Each time the spacebar is pressed, the text cursor will advance to the next note.
- In the case of the example in figure 1.25, each syllable is followed by a hyphen, centered between syllables. By holding the Option/Alt key while pressing the space bar, the text cursor can be advanced between the syllables. Holding Option/Alt while pressing the hyphen key will insert a hyphen (Fig. 1.25).

Fig. 1.24-Lyrics Tool

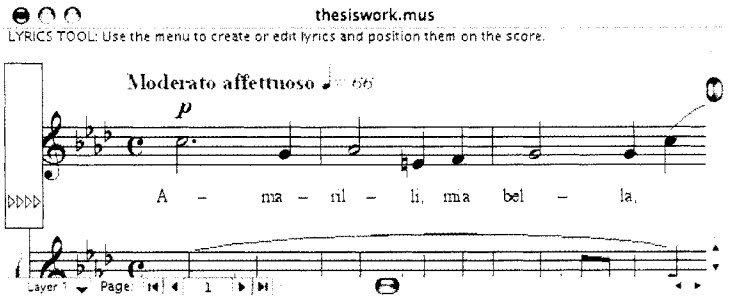

Fig. 1.25-Inserting Hyphens

- Notice in the example how the syllables are offset from the notes. It will be necessary to change some of the lyric settings to fix this problem.
- Open the Lyrics Menu (Fig. 1.26), then choose Lyric Options (Fig. 1.27).

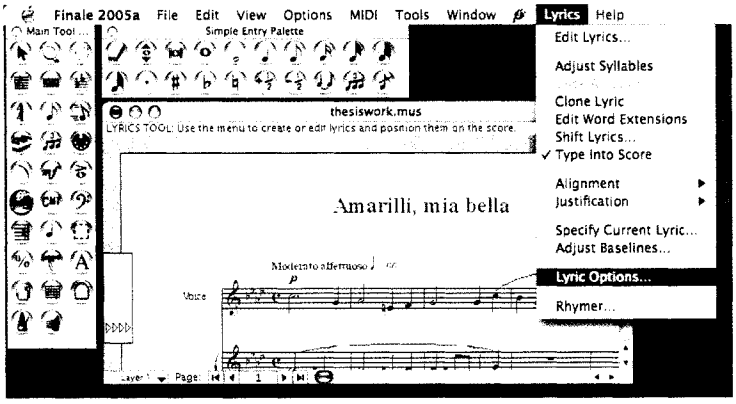

Fig. 1.26-Lyrics Menu

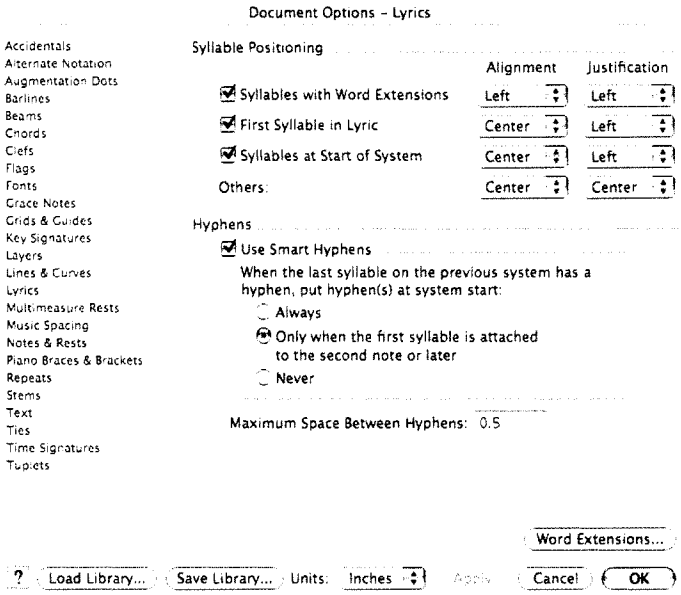

Fig. 1.27-Adjusting Lyrics in the Document Options Window

- By changing all of the alignment and justification settings to LEFT, the lyrics will line up with the correct notes (Fig. 1.28).

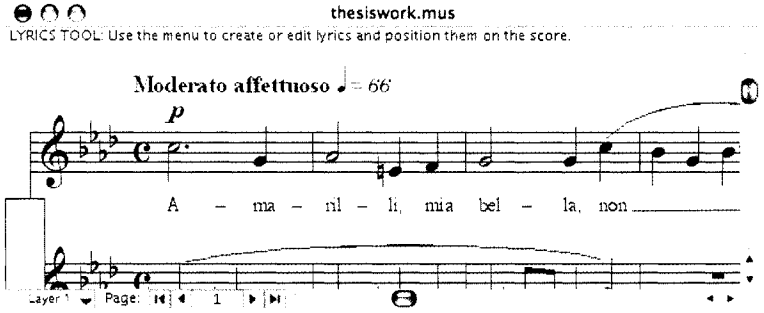

Fig. 1.28-Adjusted Lyrics

Speedy Entry:

The Simple Entry Tool is not the fastest way to enter notes into Finale. Directly to the right of the Simple Entry Tool on the Main Tool Palette is the Speedy Entry Tool (Fig. 1.29). Putting notes on the page with this option is a much faster process. To begin, it is necessary to go to the Speedy Menu, located in the menu bar, and uncheck "Use MIDI Device for Input" (Fig. 1.30)

Fig. 1.29-Speedy Entry Tool

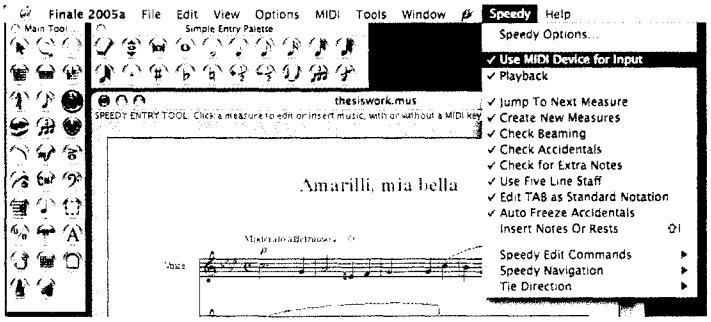

Fig. 1.30-Unchecking "Use MIDI Device for Input"

Using Speedy Entry, you use the computer keyboard to enter notes instead of the mouse.

- Clicking on a measure in the score will make the speedy entry input box to appear (Fig. 1.31).
- The horizontal cursor on the staff now indicates the note that will appear.
- Use the up and down arrow keys, moving the cursor up and down the staff.
- To enter the note, all that is necessary is to choose the note value using the number pad.

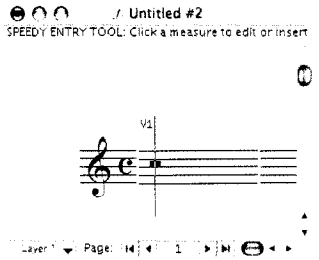

Fig. 1.31-Speedy Entry Input Box

- The numbers 3 = 𝅘𝅥𝅯, 4 = 𝅘𝅥𝅮, 5 = 𝅗𝅥, 6 = 𝅗𝅥., 7 = 𝅝

- Once a note is entered, it can be turned into a rest by pressing the Clear/Backspace key.
- Accidentals are entered using the "+" and "–" keys, and courtesy accidentals can be shown using the A key.
- To enter a chord, use the left and right arrows to move the cursor to the spot where the chord will be entered, move the cursor to the appropriate note and press the number on the number pad that corresponds to the note value.

MIDI Entry:

The most direct method for inputting notes onto a Finale score is using a MIDI (Musical Instrument Digital Interface) keyboard (or any MIDI device). MIDI input can be accomplished in either Simple Entry or Speedy Entry.

- When using Simple Entry, click the Simple Menu and make sure "Use MIDI Device for Input" is checked (Fig. 1.32).
- A cursor will appear on the score, in blue, indicating in which measure the notes that are input will be located (Fig. 1.33).

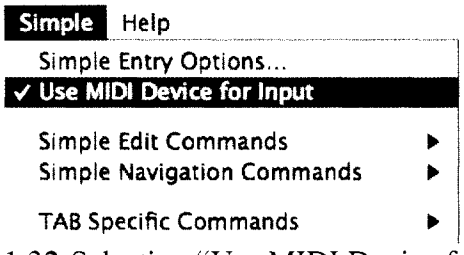

Fig. 1.32-Selecting "Use MIDI Device for Input"

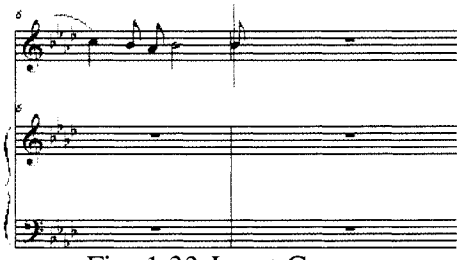

Fig. 1.33-Input Cursor

- Use the Simple Entry Palette to select the note value and use the MIDI keyboard to select the appropriate note.

- Finale will recognize sharps and flats as they are played. However, some editing may be necessary, as Finale may choose an enharmonic equivalent that is not the desired choice, (in flat keys Finale's default choice is a flat note and in sharp keys a sharp).
- In Simple Entry, you can switch seamlessly between mouse and MIDI entry without changing any settings.

Using a MIDI device in Speedy Entry is a slightly different.

- As in Simple Entry, choose "Use MIDI Device for Input" from the Speedy Menu.

There are now two choices available for note entry.

1) In the first method, press and hold the desired note on the MIDI keyboard, then select the desired note value using the number pad.
- Pressing a number on the number pad without selecting a note on the MIDI keyboard will result in a rest appearing.

2) To use the second method, select Caps Lock on the computer keyboard.
- Select a note value on the number pad. The selected note value will remain in effect until another is selected.
- The MIDI keyboard can now be used to enter one note after another at the selected value.
- In this method, rests are entered by first entering a note of the desired value, then pressing the Clear key on the computer keyboard.

Additional Tools

There are some other tools on the Main Tool Palette that should be introduced.

Staff Tool:

- In the second row on the left is the Staff Tool (the treble clef button) (Fig. 1.34).
- When this tool is selected, double clicking any staff opens the Staff Attributes Menu, allowing customization of any staff.
- The Staff Menu (Fig. 1.35) allows the user to input new staves, delete staves, and edit attributes (including clef and name).

Fig. 1.34-Staff Tool

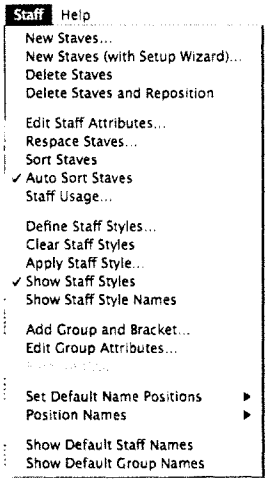

Fig. 1.35-Staff Menu

Measure Tool:

- The Measure Tool is the center button in the second row of the Main Tool Palette (Fig. 1.36).
- Measures may be added and deleted using the drop down Measure Menu.
- In addition, when the Measure Tool is selected, two selection boxes appear after each measure (Fig. 1.37).

- Clicking and dragging the upper box allows the user to stretch or shrink the length of the measure.
- Clicking the lower box opens a new selection box (Fig. 1.38), in which note placement within the measure can be adjusted.

Fig. 1.36-Measure Tool

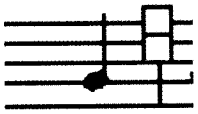

Fig. 1.37-Measure Tool Selection Boxes

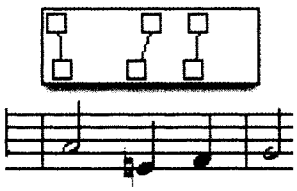

Fig. 1.38-Adjusting Note Placement

- The button on the right in the second row of the Main Tool Palette is the Key Signature Tool (Fig. 1.39).
- Using this tool, double clicking any measure will open a new window that allows the user to change key signatures.

Time Signature Tool:

- In the third row of the Main Tool Palette, the first button on the left is the Time Signature Tool (Fig. 1.40).
- By double clicking any measure, a new window opens that allows the user to insert a new time signature.

Fig. 1.39-Key Signature Tool

Fig. 1.40-Time Signature Tool

Further Study and Changes:

There are many shortcuts in Finale that were not listed in this text. An extended list of shortcuts can be found in Appendix I. In addition, Finale includes video guides and written tutorials to assist in learning the further intricacies of the program.[7]

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[7] As this text was being finished, Make Music, Inc. released their newest version of the program, Finale 2006. The most notable change, as it relates to this text, is the addition of contextual menus. Contextual menus are drop down menus that appear next to the cursor when right-clicked on a PC or control-clicked on a Mac. The contextual menus change content depending on which tool is selected and mimic the selections available in that tools specific menu, i.e. using the Simple Entry Tool, the contextual menu would match the Simple Entry menu.

In the Lab with Sibelius

Creating a New Score:

Starting a new score in Sibelius is very similar to the process introduced with Finale.

- Rather than a Setup Wizard, Sibelius presents a quick start screen (Fig. 1.41), in which the user can choose from the various options for beginning to use the program.

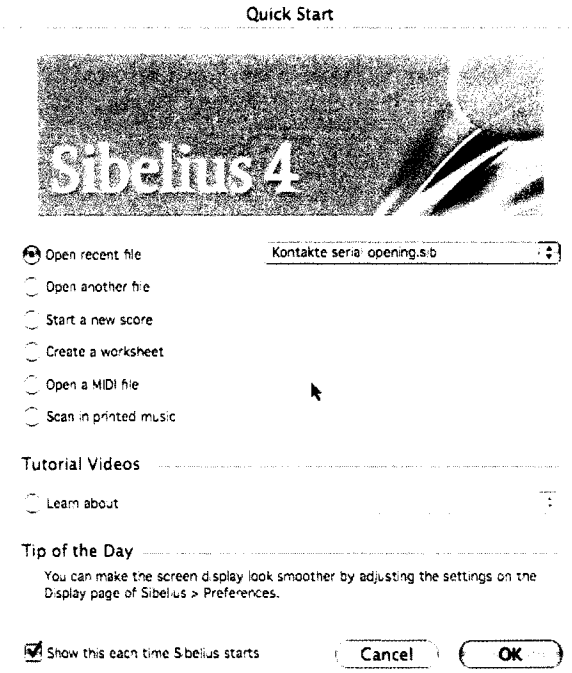

Fig. 1.41-Sibelius Quick Start[8]

- After clicking the New button, the user is presented with choices for instrumentation on the Manuscript Paper screen (Fig. 1.42), which includes most standard choices. It also has the Add Instrument button to include or remove instruments as desired.

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[8] All Sibelius screen shots used by permission from Sibelius USA, Inc.

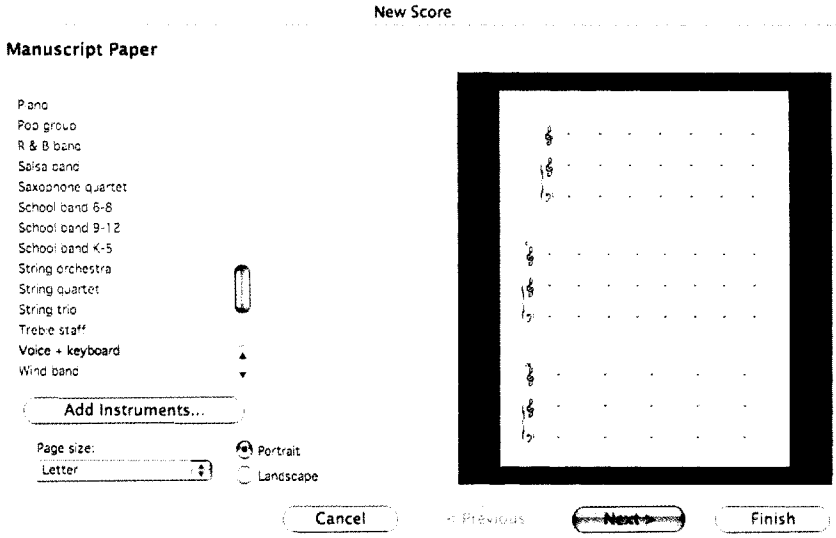

Fig. 1.42-Manuscript Paper Screen

- The next window, House Style (Fig. 1.43), allows the selection of the type of output desired, including Standard, Jazz, and Handwritten.

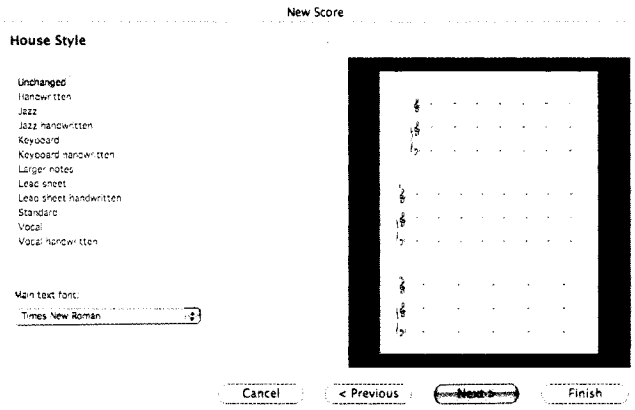

Fig. 1.43-House Styles

- The window that follows is the Time Signature and Tempo selection (Fig. 1.44), in which the desired time is input as well as a pickup measure (anacrusis), and tempo markings for the score.
- Clicking Next brings up the Key Signature window (Fig. 1.45), that displays both major and minor keys.

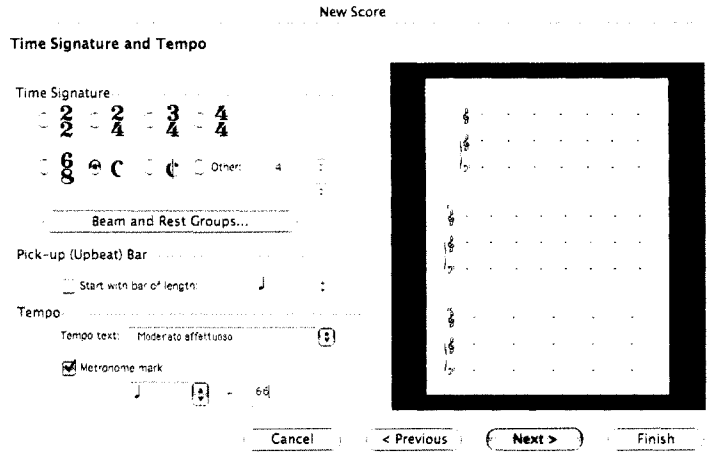

Fig. 1.44-Time Signature and Tempo

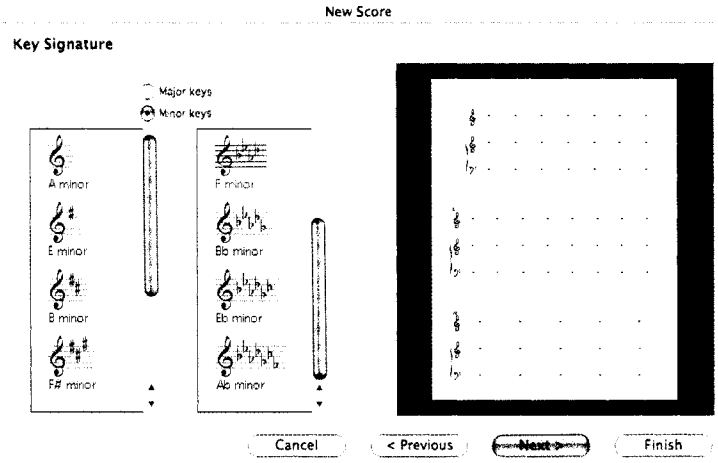

Fig. 1.45-Key Signature

- The Score Info window (Fig. 1.46) follows and allows the user to input Title, Composer, Lyricist, and Copyright information.
- Selecting the Finish button finalizes the creation of the basic score (Fig. 1.47).

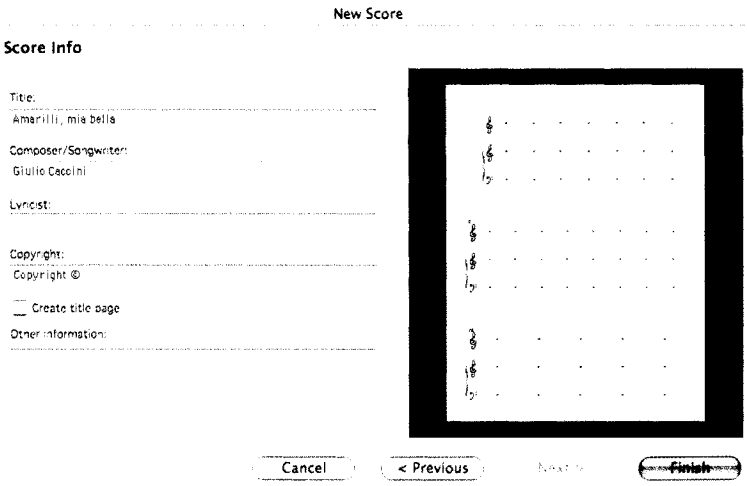

Fig. 1.46-Score Info

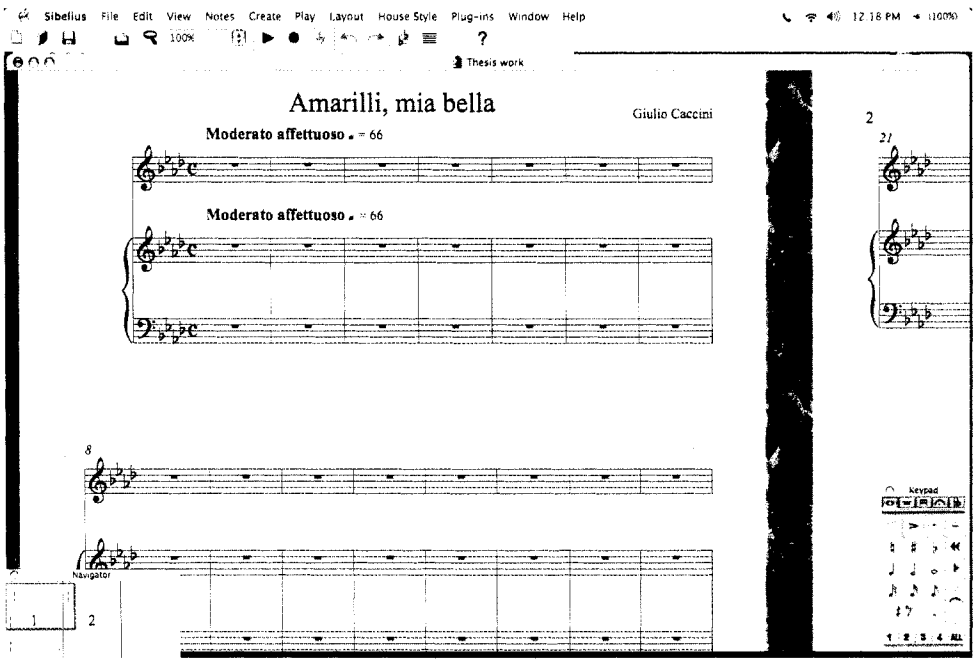

Fig. 1.47-Finished Basic Score

Notice that Sibelius' layout is quite a bit different from Finale. Besides the score, the only windows that appear are the Keypad and the Navigator.

- The Keypad (Fig. 1.48) is where the user chooses note values, rests, sharps and flats, voices (layers in Finale), slurs, beaming, and some articulation markings.

- One aspect of Sibelius that is especially helpful is that the Keypad corresponds with the number pad on the computer keyboard. The user then has the ability to use the number pad at any time to change the note value without touching the mouse, and a visual cue is available at all times.

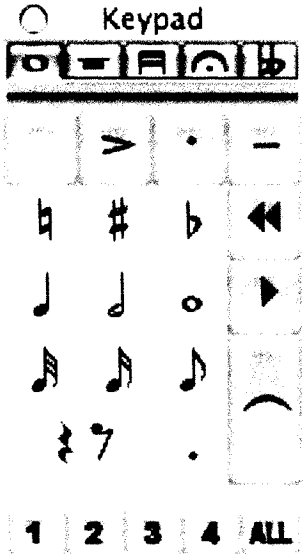

Fig. 1.48-Keypad

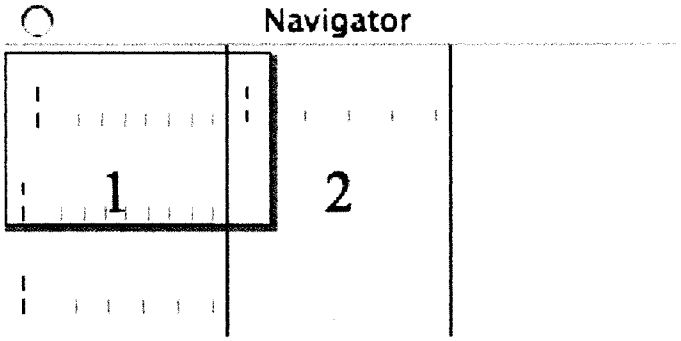

Fig. 1.49-The Navigator

- The Navigator (Fig. 1.49) allows quick movement to any part of the score by dragging the view window (the transparent rectangle overlaying the score in figure 1.49) to the desired location.

In the example score, shown on the previous page in figure 1.47, you will notice that Sibelius defaulted with tempo markings above both the vocal and piano staves. For this example, it is necessary to remove the one above the piano staff.

- At any time while working in Sibelius, the method for returning to the selection tool is to press the Escape key twice on the computer keyboard.
- Once this is accomplished, simply click on the tempo marking, which becomes highlighted in blue, and press delete on the computer keyboard.

Entering Notes:

Creating notes on the score begins with note values. Selecting note values in Sibelius can be accomplished in three ways.

1) The most obvious is to select the note value on the Keypad using the mouse.

2) A faster way is to use the number pad on the computer keyboard, which, as stated earlier, corresponds directly to the keypad.

3) The third method is most useful for laptop computers, whose keyboards do not include a number pad.

  - Pressing option concurrently with either Z, X, C, A, S, or D (control + alt on a PC), where Z=𝅘𝅥𝅯, X=𝅘𝅥𝅮, C=𝅘𝅥,etc.

  - Q, W, and E, which represent the natural, sharp, and flat signs.

- Once the note value is selected, the buttons on the Keypad and the cursor arrow will both turn blue (Fig. 1.50).
- When the cursor arrow is moved over the score, a ghosted note will appear under the cursor, showing the pitch that will be placed (Fig. 1.51). Simply click when the correct pitch is under the cursor and the note will appear.
- The note will appear in blue, making it clear that it is in the first voice and that it is selected (Fig. 1.52).

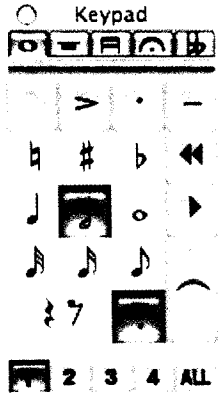

Fig. 1.50-Note Values

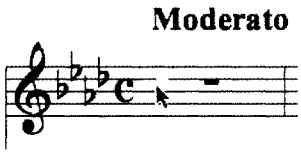

Fig. 1.51-Ghosted Note

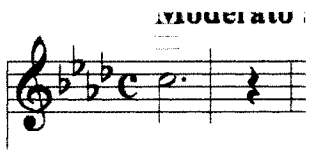
Fig. 1.52-Note in First Voice

- If the pitch is incorrect, up and down arrows may be used to change the pitch of the note.

Another method for entering notes is to use a MIDI keyboard. In Sibelius, there is no need to switch between entry modes. At any time, the user may enter notes using either the mouse or MIDI keyboard.

Creating Chords, Intervals, and Harmonies:

There are a few different methods to create chords with Sibelius.

- You can use the mouse to place a note directly above or below a previously entered note.
- When a note has been entered and is still highlighted in blue, pressing the any of the numbers 1-9 (unison through ninth) on the main computer keyboard (not the number pad) will produce a second note above the selected note. Holding shift while pressing the numbers 1-9 will produce an interval below.

Sibelius uses a function entitled Voices to produce a different note value at the same location as a previously entered note. Using Sibelius 4, voice selection may be accomplished in three ways.

1) At the bottom of the Keypad are the numbers 1-4, which correspond to voices 1-4 (Fig. 1.53) (Sibelius 2 does not include this option).

2) You will find voice selection in the Edit Menu (Fig. 1.54).

3) Pressing Option/Alt while pressing the numbers 1-4 on the main keyboard (not the number pad) will change the voice as well.

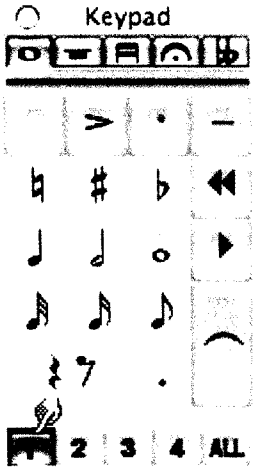

Fig. 1.53-Keypad Voice Selection

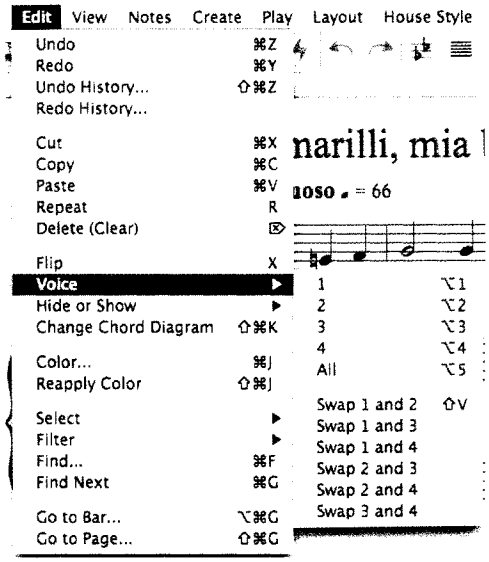

Fig. 1.54-Edit Menu Voice Selection

- The notes and cursor change color according to the voice selected: Voice 1 – Blue, Voice 2 – Green (Fig. 1.55), Voice 3 – Yellow, Voice 4 – Purple.

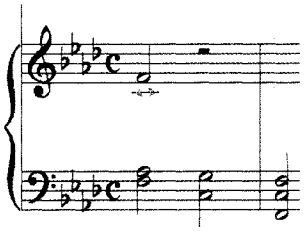

Fig. 1.55-Voice 2

Adding Expression Markings:

Now that there are some notes on the page, it is time to start adding expression markings to make the music come to life. The opening notes of this piece are marked *piano*, with that dynamic marking above the vocal line and in between the piano lines.

- Press the Escape key twice to exit note entry.
- Click on the note to which you wish to add the piano marking.
- Next select the Create menu, scroll down to Text, and move over to Expression (Fig. 1.56). (Notice that there is a shortcut next to Expression, ⌘E on a Mac, or Ctrl+E on a PC).

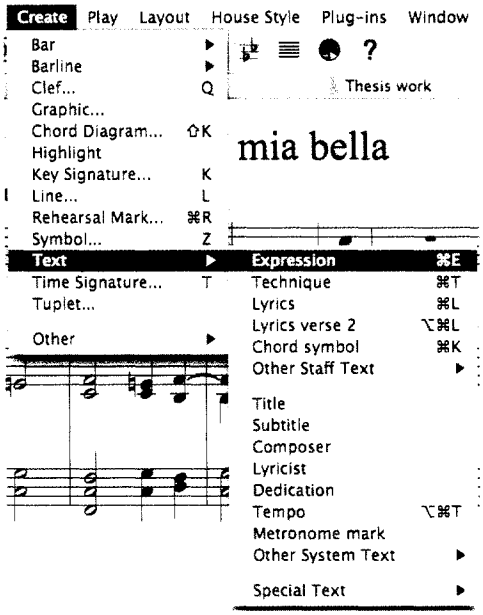

Fig. 1.56-Adding Dynamic Markings

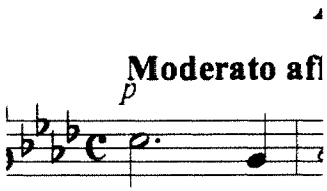

Fig. 1.57-Misplaced Piano Marking

- A text cursor will appear above the note, allowing you to type a *P*, which will appear in the appropriate font.
- Pressing the Escape key once will remove the cursor, but leave the piano marking selected. In figure 1.57, the piano marking is to close to the tempo marking.

- Given that it is still selected, as is evident by its blue color, simply use the arrow keys to move it to a better location.

Once the piano marking is in place, it is necessary to add slurs.

- Press Escape twice to change to the selection tool and select the starting note for the slur.
- Click on the Create Menu and scroll down to Line (the shortcut is the L key).
- This will open a new window, which contains all the available lines (Fig. 1.58).
- Choose the appropriate slur shape and press the OK button.

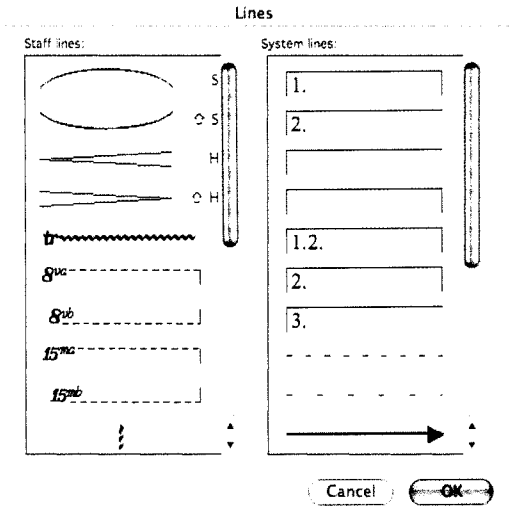

Fig. 1.58-Line Selection

- The slur will appear on the score with a small box at the end, furthest from the selected note (Fig. 1.59).
- Simply drag the square to the note where the slur ends or use the arrow keys for a more fine-tuned adjustment (Fig. 1.60).
- Clicking and dragging the slur at any point except the end, will allow the user to change the shape of the slur, to accommodate text or markings.

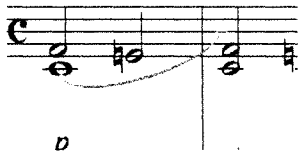

Fig. 1.59-Slur with Adjustment Box

Fig. 1.60-Slur Corrected

Another common expression is the crescendo/decrescendo. In Sibelius, they are found in the Line Window (Fig. 1.58).

- Select the starting note for the crescendo (if it is a long crescendo, you can then shift click the ending note).
- Then select the crescendo from the Line Window.
- Sibelius does offer a shortcut for crescendos. Select the starting note (click) and ending note (shift click), then press the H key (Shift+H for decrescendo) and the crescendo will appear.

Adding Lyrics:

To insert the lyrics for the music:

- Select the starting note for the lyrics, then move to the Create menu, scroll down to Text, and select Lyrics (see Fig. 1.56) (⌘L on Mac, Ctrl+L on PC).
- In this case, there is a hyphen between each syllable of the lyrics.
- Pressing the hyphen key will automatically advance the cursor to the next note for lyrics input.
- To move between notes where lyrics begin a new word, simply press the space bar to advance the cursor.

- This piece of music also includes an English translation. Using Sibelius' "Lyrics verse 2" option (see Fig. 1.56), the program will place a second line of text below the original (Fig. 1.61).

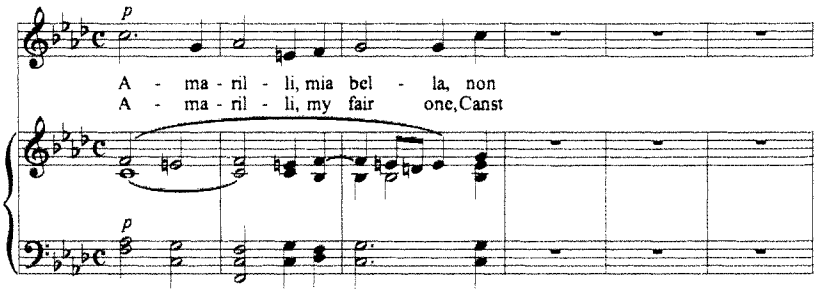

Fig. 1.61-Music with Second Lyrics Added

In the above image, while the lyrics are correct, the spacing between "one" and "Canst" should be wider. Additionally, in the original music, this system only contains four measures.

- Select the barline that follows the fourth measure and press return to force a system break.
- While that gives quite a bit more space, a little more room between the words "one" and "Canst" would look better (Fig. 1.62).

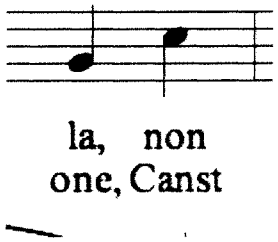

Fig. 1.62-Tight Spacing

- To increase that space, select the note above "non/Canst", press and hold Shift+Option on a Mac, Shift+Alt on a PC, then use the arrow keys to move the note to the right (the lyrics are attached to the note and will move automatically with the note).

Beams:

As in Finale, there may be times when the default beaming setting in Sibelius is undesirable. Sibelius automatically beams four eighth notes together in a 4/4 measure (Fig. 1.63).

There are two options for changing the beams.

- In the first method, only one beam can be changed.
- Select the note where the new beam will start (see Fig. 1.63).
- On the Keypad, in the top row of buttons, the third button from the left controls beaming options (Fig. 1.64).

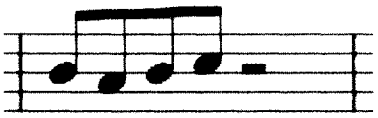

Fig. 1.63-Beamed Eighth Notes

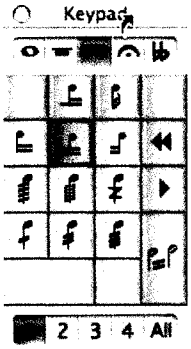

Fig. 1.64-Beaming Options

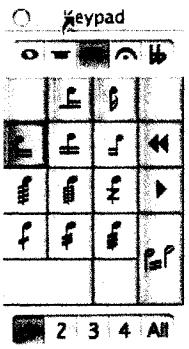

Fig. 1.65-Break Beam

- By selecting the beam button shown in Figure 1.65, the beam will be broken as desired (Fig. 1.66).

While the above method works well for individual instances, the second method allows the user to select multiple measures to change beams.

- To change the beam to two eighth notes in one or more measure, click a blank portion of the measure to select the entire measure (Fig. 1.67)(You may Shift-Click additional measure to change them as well).

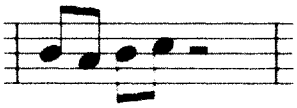

Fig. 1.66-Fixed Beam

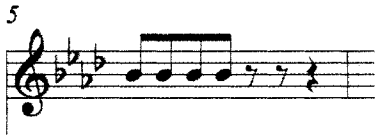

Fig. 1.67-Measure Selected

- Click on the Notes Menu and scroll down to Reset Beam Groups (Fig. 1.68).
- The Reset Beam Groups window will appear (Fig.1.69) with eighth notes set to "4,4" meaning, two groups of four eighth notes.

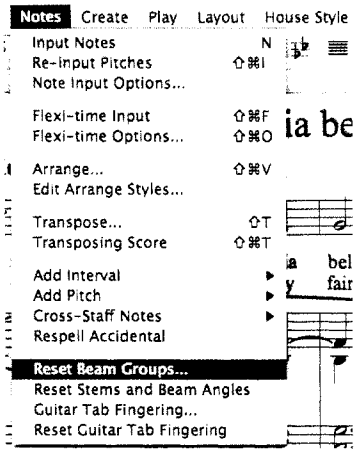

Fig. 1.68-Notes Menu – Reset Beam Groups

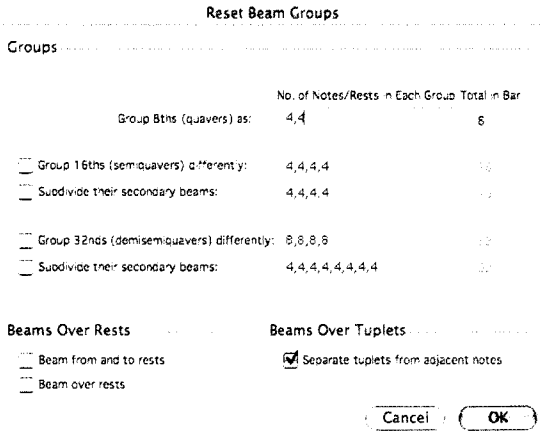

Fig. 1.69-Reset Beam Groups Window

- Resetting this to 2,2,2,2 will change that to four groups of two eighth notes. Click the OK button and the change will be complete (Fig. 1.70).

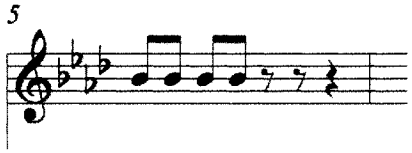

Fig. 1.70-Reseting Beams Complete

This chapter is just the beginning of what Finale and Sibelius are able to do. The best way to learn either program is to use them extensively and problem-solve as you learn. Most attributes and functions can be found by thinking about how they work in the score and following a logical path to find them. There are a huge number of shortcuts in

both programs provided in the Appendix, along with a copy of the first page of the musical example used for this section. Students are encouraged to try both programs to decide which one is better suited to them.

Chapter 2

MIDI and Sequencing

History:

Electronic music has developed over time in many ways. Every attempt to create music using electronic instruments was an experiment and the types of instruments produced were quite varied. Karlheinz Stockhausen is one composer who used electronics to create compositions. One of his techniques is called a Tape Loop, whereby, he could record a sound and replay it at different speeds to effect changes in the sound and allow the sound to be rerecorded into his music.[1] Terry Riley and Pauline Oliveros later expanded the idea at the San Francisco Tape Music Center during the 1960's. These composer's would record sounds on reel to reel tape recorders, but, rather than play them normally, they extended the tape to run through multiple machines, picking up new sounds at each machine and producing music in a somewhat autonomous way.[2] More current composers using this technique, including Brian Eno and Robert Fripp, use digital recorders rather than magnetic tape to accomplish the same effect.[3]

Lev Sergeivitch Termen, who later changed his name to Léon Theremin, developed another direction for electronic instruments. His musical instrument, dubbed

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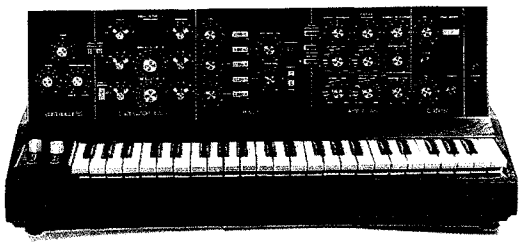
[1] Robin Maconie, *The Works of Karlheinz Stockhausen,*(London: Oxford University Press, 1976), p. 136.
[2] Edward Strickland, "Riley, Terry (Mitchell)," *Grove Music Online* ed. L. Macy (Accessed March 4, 2006), <http://www.grovemusic.com>.
Timothy D. Taylor, "Oliveros, Pauline," *Grove Music Online* ed. L. Macy (Accessed March 4, 2006), <http://www.grovemusic.com>.
[3] Michael Peters, "The Birth of the Loop," *Looper's Delight*, < http://www.loopers-delight.com/history/Loophist.html>.

the Theremin, was developed in 1917. The Theremin is an instrument that looks like a box with a metal rod sticking out of the top and a metal loop attached to the side. The performer moves one hand around (but not touching) the loop to control volume and around the antennae to control pitch.[4]

In the 1950's, a young man by the name of Robert Moog began building and selling Theremins. In the 1960's, Moog began to create synthesizers and electronic keyboards that produced sounds through solely electronic means. Working to create a usable product, Moog's company began to sell the first modular synthesizer to consumers in 1964.[5]

Theremin playing his invention in 1991[6]



The Minimoog Synthesizer[7]

By the 1980's, developers had begun to create synthesizers that could be connected to each other using cables, allowing one synthesizer to control the other. Dave Smith, the owner of Sequential Circuits, in a paper submitted to the Audio Engineering Society, suggested a system called MIDI, or Musical Instrument Digital Interface, as an

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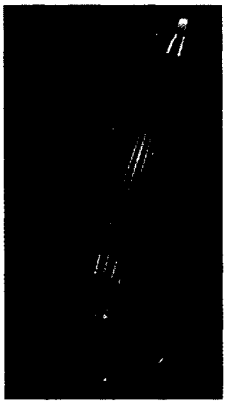
[4] Richard Orton and Hugh Davies, "Theremin (Termenvoks)," *Grove Music Online* ed. L. Macy (Accessed March 4, 2006), <http://www.grovemusic.com>.
[5] Hugh Davies, "Moog, Robert A(rthur)," *Grove Music Online* ed. L. Macy (Accessed March 4, 2006), <http://www.grovemusic.com>.
[6] Photo courtesy of Obsolete.com
[7] Photo courtesy of MoogArchives.com

industry standard for instrument communication. MIDI had been developed by the Roland Corporation and had been further refined with Smith's assistance. His company was the first to ship a keyboard, the "Prohpet 600," with MIDI included. Roland soon shipped their version of a MIDI keyboard.[8]

Though computer technology has developed far faster and more compact methods for connecting electronics to each other since the 1980's, including USB and Firewire (both are faster and more flexible in their possible uses than MIDI), the industry standard for musical instruments today is still a MIDI connection.

While most MIDI instruments are based on keyboards, the range of MIDI capable instruments are widely varied and include: Guitars, Violins, Winds instruments, and even an accordion.

Examples of MIDI Instruments



Zeta Music System's[9]
Jazz Fusion Violin

Roland's FR-7 V-Accordion [10]

Yamaha's WX-5[11]
Wind Controller

[8] David Smith, e-mail message to author, March 7, 2006.
[9] Photo courtesy of Zeta Music Systems
[10] Photo courtesy of Roland Corp.
[11] Photo courtesy of Yamaha

MIDI is a system of communication, where information from a MIDI equipped instrument (or a computer) can command the functions of another MIDI equipped instrument. All of the channels are available for use with any patch (patches are the instrument choices available in a synthesizer), except for channel 10, which is designated as the drum channel.

While communicating with other instruments was a great invention, MIDI really became an incredible musical tool with the computer revolution. In the 1980's, computers finally became affordable to the masses. Apple computer began to produce computers with a simple user interface and was followed shortly by Microsoft moving from its text-based DOS operating system to Windows. Consumer level music software and hardware quickly began development. The first piece of hardware that needed for musicians was a MIDI Interface, a small box that contained both MIDI and computer connections, allowing MIDI instruments to be connected to a computer.

The next step was to develop software to work with the instruments, resulting in sequencing software. While notation software can be equated with word processing, sequencing software is akin to a player piano. When connected to MIDI instruments through a MIDI interface, a computer running sequencing software can read and record all of the performance information from the MIDI instrument, allowing a composer to create music that can be played back and edited at will. Notation software can playback the music that has been input, but it does so in exact rhythmic time, with no variation. Humans, unlike computers, do not play in exact rhythmic time. We stretch music and compress it, making it breathe, with ebb and flow. Sequencing software can record these

variations and play them back, exactly as they were recorded. It can then be saved in a MIDI file format that can be read by notation software.

In 1985, a new software company called Mark of the Unicorn (MOTU) began shipping a new sequencing program, designed for Apple's Macintosh computer, entitled Performer.[12] Twenty years later, MOTU is still producing software based on that original design, now renamed Digital Performer. There are many other sequencers available on the market for both Mac and PC's, including Steinberg's Cubase, Apple's Logic and GarageBand™, Cakewalk's Home Studio and Sonar. However, in the SJSU music lab, the only available sequencing programs are MOTU's Digital Performer and Apple's GarageBand, both available only for Apple's Macintosh computers.

While most students see the need for music notation programs in their academic careers, sequencing software seems to be designed only for composers. It gives them the ability to write and playback all the various parts of a composition, with their intended "feel" still intact in the music. But what about for a classical violinist? Sequencing software can be used as a virtual accompanist. By programming the accompaniment part into a sequencer, he or she can practice with it over and over again, at any tempo. While it is not a replacement for a live accompaniment, it offers an acceptable substitute for beginning practice or until a musician can find someone to rehearse with. Pop bands use sequencers all the time to replace parts that are either overly repetitive, or when musicians to play those parts are unavailable. Jamey Aebersold's company, Jamey

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[12] "About MOTU," <http://www.motu.com/other>

Aebersold Jazz[13], makes play-along CD's of jazz music for aspiring musicians, but his library does not include every jazz song ever written. A musician can input any song into a sequencer and have a rhythm section to play along with indefinitely.

The following sections will give new users a brief look at how to use both Digital Performer and GarageBand. Digital Performer is a professional level program designed for studio use, while GarageBand is an entry-level program designed with the average consumer in mind.

[13] Jamey Aebersold Jazz - <http://www.aebersold.com>

Digital Performer

Upon launching Digital Performer, the user is presented with an opening screen (Fig. 2.1). Clicking the New button in the lower right corner moves the user to a new document save screen (Fig. 2.2). Unlike other programs, this one prompts you to save your work immediately, rather than wait until part of the project has been completed. This is a good time to decide where the file should be saved on the computer, whether it is the default MOTU DP4 folder, or some other location.

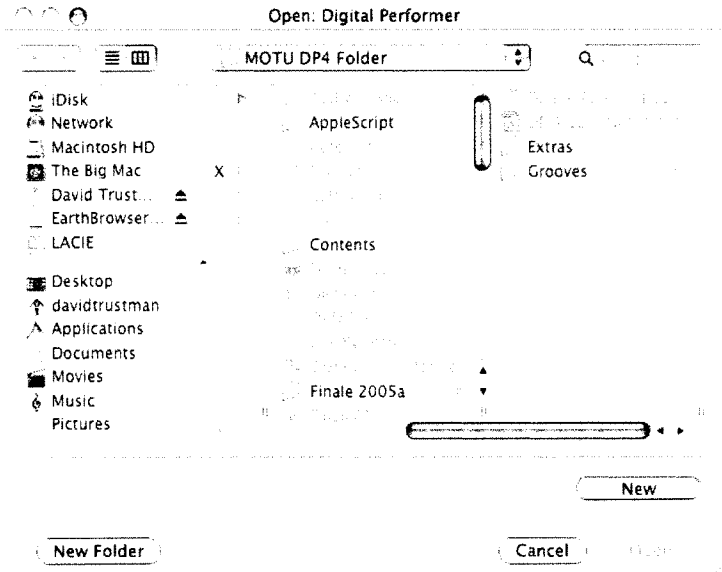

Fig. 2.1-Digital Performer's Opening Window[14]

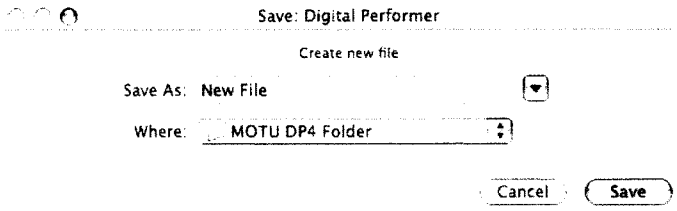

Fig. 2.2-Digital Performer's Save Screen

Basic Contols:

- Once the file has been saved, Digital Performer's main screen appears (Fig. 2.3).

While at first this may seem like an overwhelming set of windows, when broken down into parts, you will find that there is quite a bit of repetition. In this introduction to

[14] All Digital Performer screen shots used by permission from MOTU, Inc.

Digital Performer, only those controls necessary for a basic understanding of the program will be discussed.

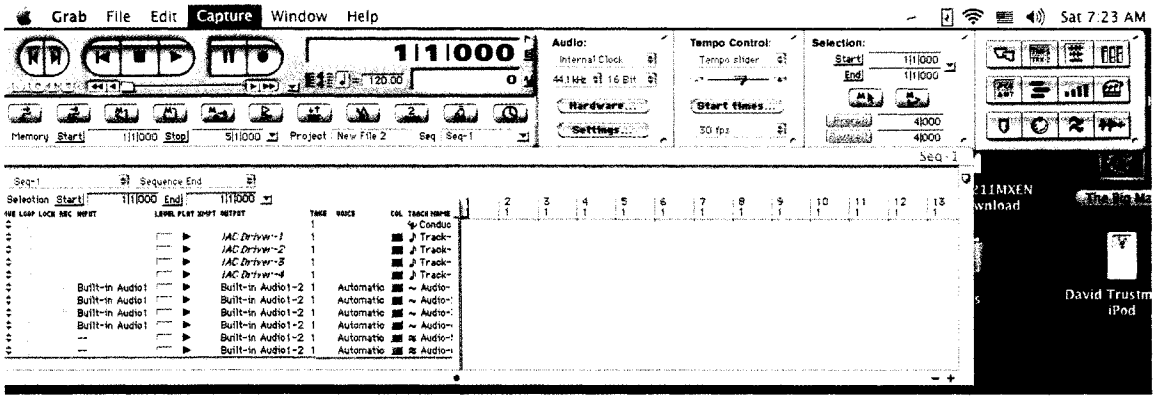

Fig. 2.3- Main Screen

- The screen presented in Figure 3 can be dissected into several specific parts. The Main Control Window is the first in order of importance (Fig. 2.4) and can be found in the upper left corner of the window. These controls are similar to those found on most recording devices, though with a few interesting additions.
- The primary buttons are Rewind, Stop, Play, Pause, and Record (Fig. 2.5).

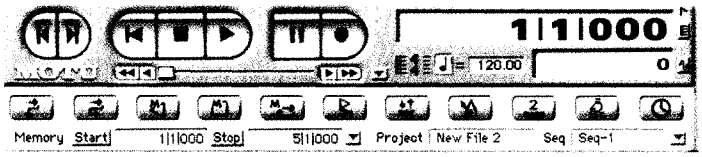

Fig. 2.4-Control Window

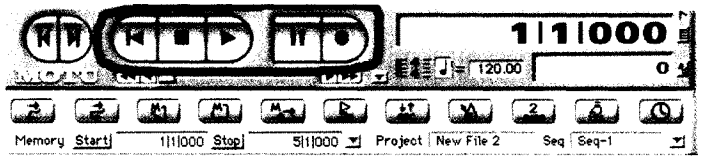

Fig. 2.5-Primary Buttons

- Adjacent to these buttons is a window, which displays the bar number and beat within that bar (Fig. 2.6). This window becomes very important as the recording progresses,

because it allows the user to locate a specific place in the music to begin recording required parts.

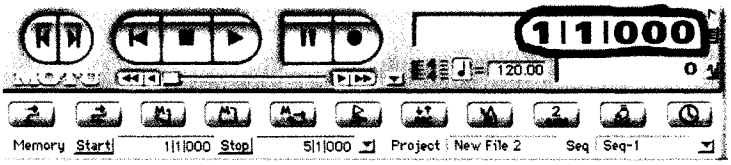

Fig.2.6-Bar Number and Beat Display

- Below the bar number window is a smaller window that displays the Time Signature and Tempo of the piece being recorded (Fig. 2.7a). While this window does allow the user to change the tempo and the note value that goes with the tempo, it is not the place to change the meter of the piece.

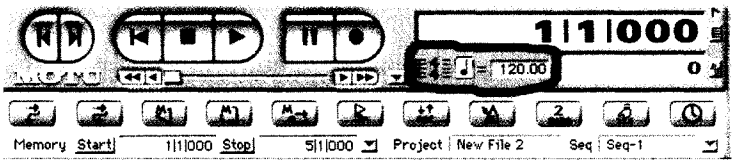

Fig. 2.7a- Time Signature and Tempo

- Meter changes are part of the Conductor's Track information. To change the meter of the piece, click the Project Menu, scroll down to Modify Conductor Track, and move over to Change Meter (Fig. 2.7b).
- The Change Meter window (Fig. 2.7c) will open, allowing the user to set any meter desired for the piece.

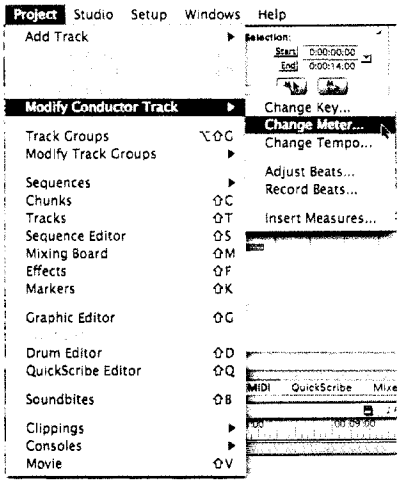

Fig. 2.7b-Changing Meter

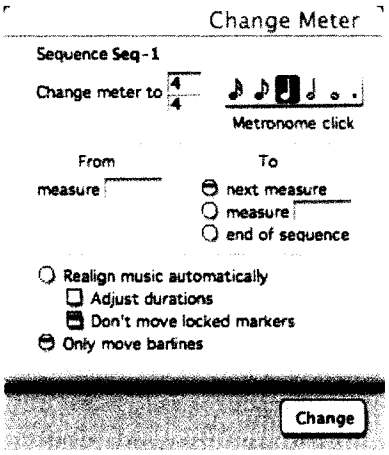

Fig. 2.7c-Change Meter Window

- Immediately below the Tempo Window are two of the most important buttons used for recording a new piece, the Metronome and 2 Bars buttons (Fig. 2.8). When engaged, the user will hear a constant metronome beat and will be given a two bar count off before recording begins. Note: If the piece includes a pickup or anacrusis beat, the user must wait through the two bar count off and begin recording in measure one.

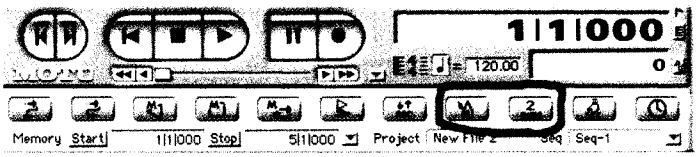

Fig. 2.8-Metronome and 2 Bar Intro Buttons

- Directly below the Control Window is the Sequence Editor (Fig. 2.9). This is the main action window for Digital Performer. This window contains the information for each track that is recorded and allows the user to edit each part individually.

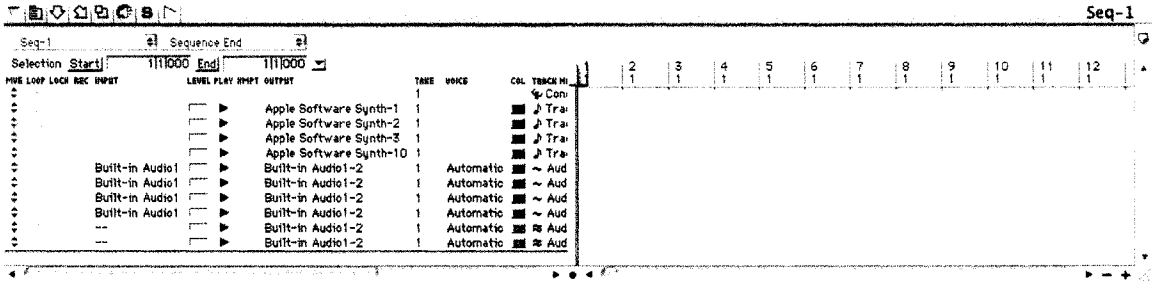

Fig. 2.9-Sequence Editor

- In the figure above, you will notice that the portion of the window on the right, containing the bar numbers, is covering some of the information on the left. To remedy this situation, so that all of the controls needed for this project are available, it is necessary to adjust the slider at the bottom of the window (Fig. 2.10).

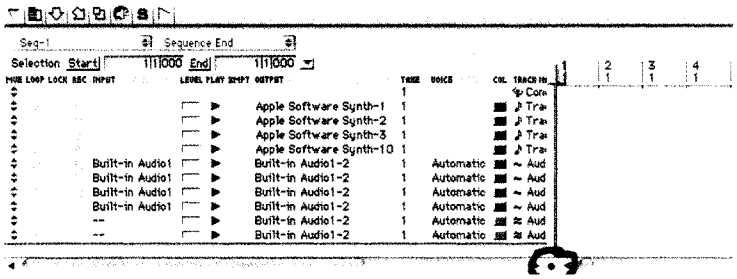

Fig. 2.10-Expanding the Window View

- By moving the slider to the right, the rest of the pertinent information can be seen without scrolling the window (Fig. 2.11).

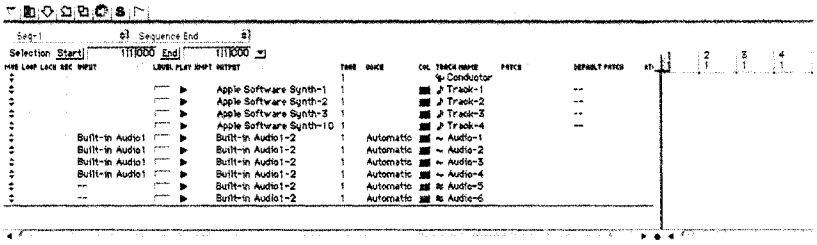

Fig. 2.11-Expanded View of the Left Half of the Window

While there appears to be quite a bit of information in this window, there are multiple tracks being represented on the screen. By looking at a single track (Fig. 2.12), it will be easier to understand the parts of this window.

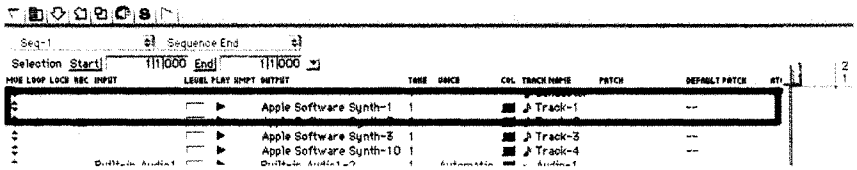

Fig. 2.12-A Single Track

- The first thing to notice is the Track Name (Fig. 2.13). In this case we are examining Track-1. Holding the Option key while clicking the name of the track, Track-1, will allow the user to enter a custom name for the track.

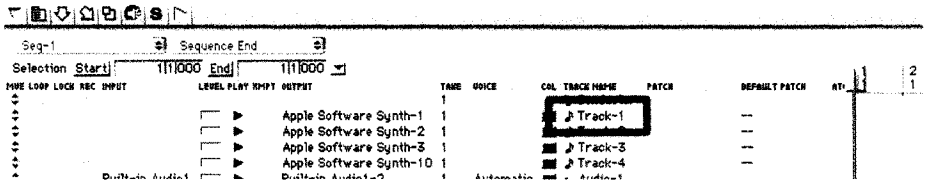

Fig. 2.13-Track Name

- Next, it is necessary to decide what output device is going to be used (Fig. 2.14).

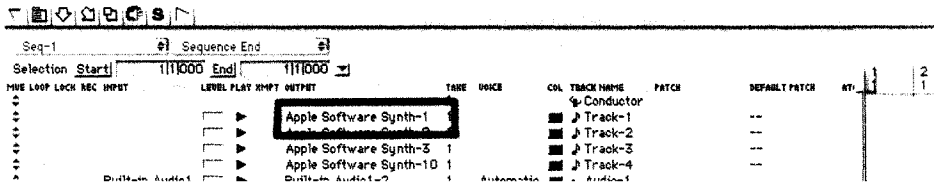

Fig. 2.14-Output Device

- Clicking the name of the current device, in this case Apple Software Synth, opens a drop down menu in which all the devices (synthesizers, sound modules, etc.) connected to the computer appear (Fig. 2.15).

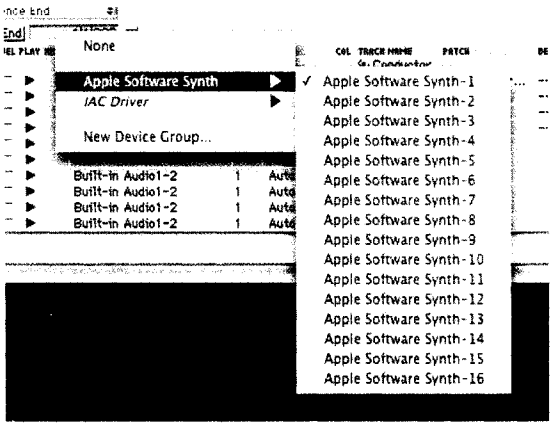

Fig. 2.15-Output Device Selection

- In this case, there are no external devices attached to the computer and the only option is to use the Apple Software Synth, an internal, computer synthesizer. It is important to notice that the Apple Software Synth appears sixteen times, representing the sixteen midi channels. Each track should have its own midi channel. Note: In the SJSU Lab, each computer is attached to a synthesizer that will appear on the output list, however, none of these are attached to speakers, so the only way to hear tracks assigned to them is through headphones.

After choosing an output device, it is time to decide what sound that device will play. Synthesizer sounds are called Patches (Fig. 2.16).

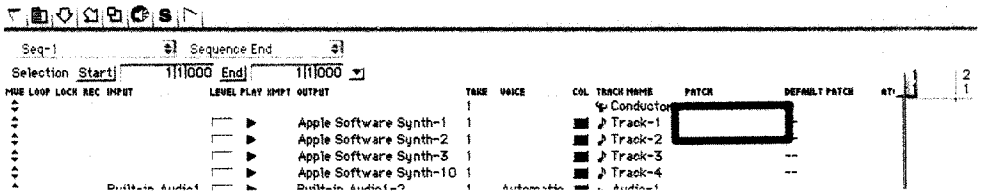

Fig. 2.16-Patch Selection Window

- Clicking the Patch window will open a drop down menu containing all the available patches for the selected output device (Fig. 2.17).

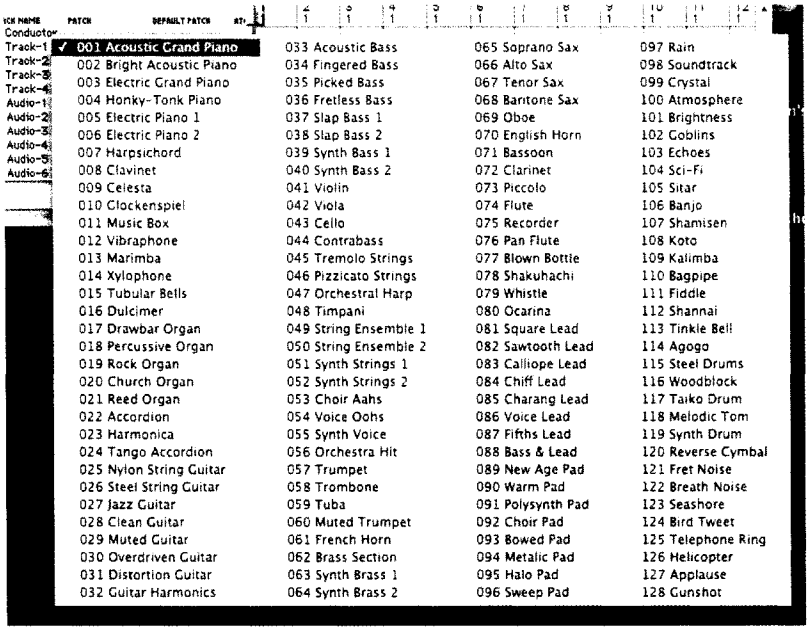

Fig. 2.17-Patch's Available in Apple Software Synth

Note: The patch window shows or selects the patch currently being played. To ensure that the patch the user wants to play at the beginning of a given track is saved with the file, it is necessary to select a Default Patch (Fig. 2.18).

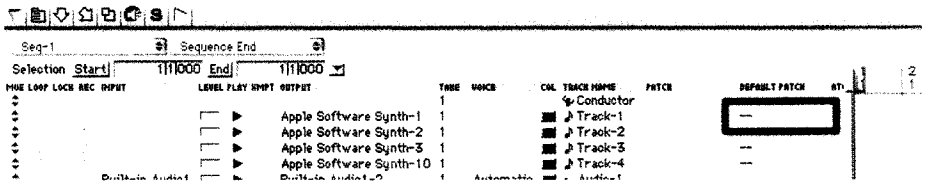

Fig. 2.18-Default Patch Selection

Recording:

After selecting the patch, it is important to make sure that Digital Performer is set to record on this track. The record button will appear red on whichever track is being recorded (Fig. 2.19).

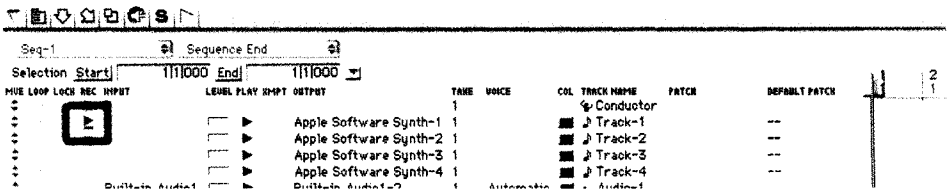

Fig. 2.19-Track Record Selection

Now that a track has been designated for recording, simply click the record button on the main control panel (Fig. 2.5) and begin recording. Once a few tracks have been recorded, the edit window will show the basic recorded information in the right side of the window (Fig. 2.20).

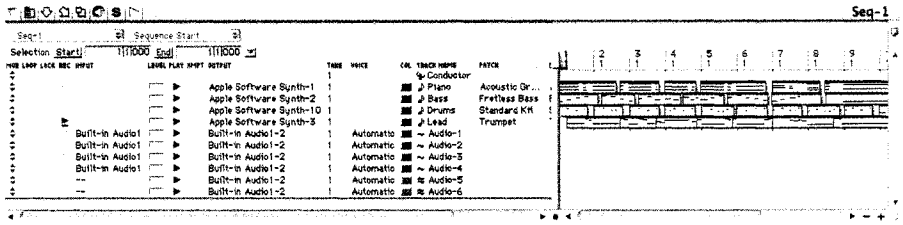

Fig. 2.20-Recorded Information in the Right Side Window

In the figure above, the user appears to have run out of MIDI tracks available for recording. The rest of the tracks seen are audio tracks. To add a new MIDI track (Fig. 2.21):

- Click on the Project menu.
- Scroll down to Add Track.
- Click on MIDI Track (shortcut- Shift+⌘+M).

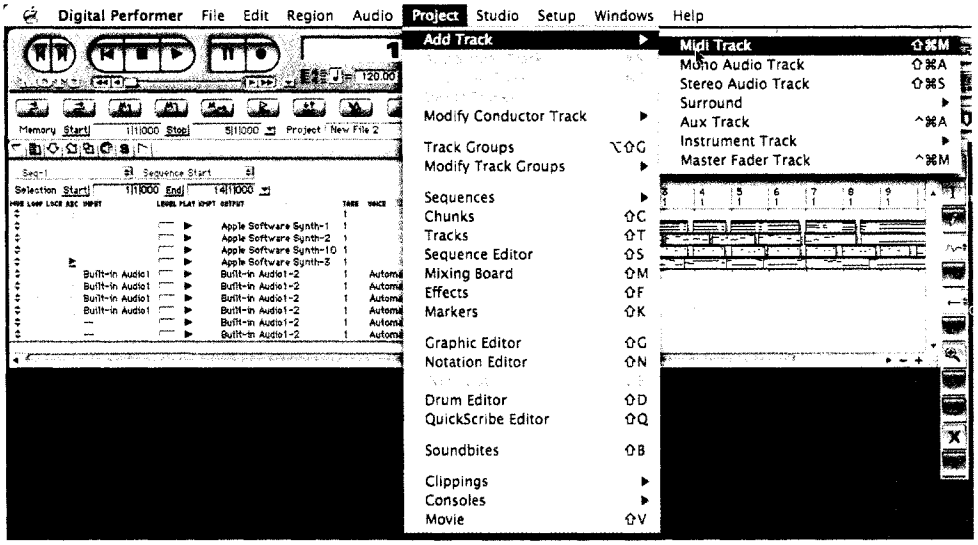

Fig. 2.21-Adding MIDI Tracks

Editing:

The ability to easily edit tracks in Digital Performer makes it a joy to use. There are a few different windows for viewing pre-recorded information. By double clicking any section of the recorded music in the edit window (highlighted in Fig. 2.22) the Event List window will open (Fig. 2.23).

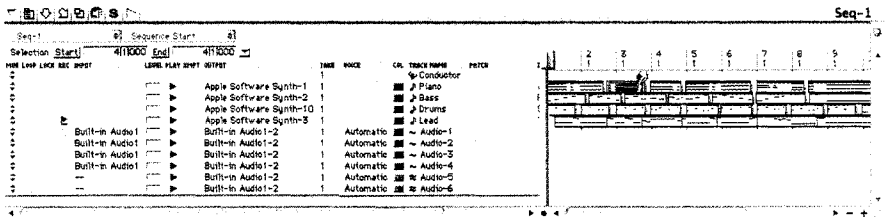

Fig. 2.22-Selecting a Specific Section of Recorded Information

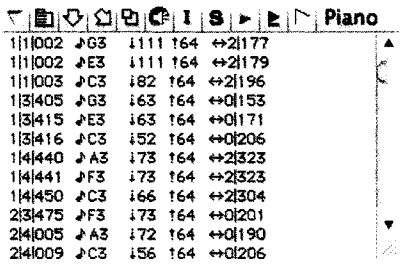

Fig. 2.23-Event List Window

- The Event List window shows when each action was taken in the given track. From left to right, in the first line, it shows location (Measure 1, Beat 1, Tick 002 (Quarter Notes are divided into 480 ticks)), pitch (G3), on and off velocity (which refers to the rate the specific key was pressed (attacked) and released (111 and 64, respectively)), and duration (the time between attack and release (2 | 177, two quarter notes and 177 ticks)).
- To see an exploded view of the notes played, click on the drop down menu button (which looks like a little menu, second from the left, next to the downward facing triangle) at the top of the Event List window and scroll down to Graphic Editor (Fig. 2.24).
- The Graphic Editor window (Fig. 2.25) shows a piano keyboard on the left and notes played and their durations on the right. By clicking any note, the user can change the note or eliminate any unwanted notes.

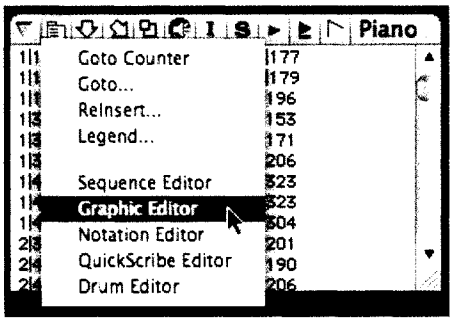

Fig. 2.24-Selecting the Graphic Editor

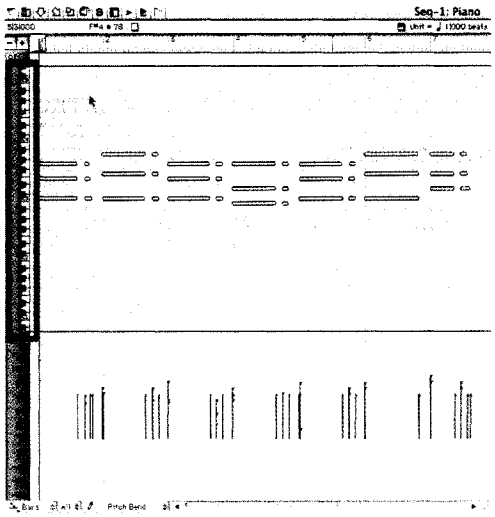

Fig. 2.25-Graphic Editor

- The Event List window also gives the user the ability to change patches midway through a tracks playback. Clicking the "I" (insert) opens a drop down menu (Fig. 2.26) in which Patch Change can be selected.
- This inserts a patch change into the Event List (Fig. 2.27). The user then designates which measure gets the patch change and by clicking the name of the default instrument (Acoustic Grand Piano in this case) the full list of available patches will open.

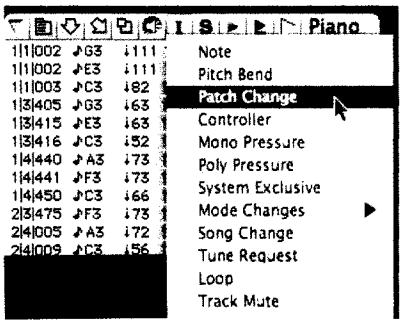

Fig. 2.26-Insert Menu

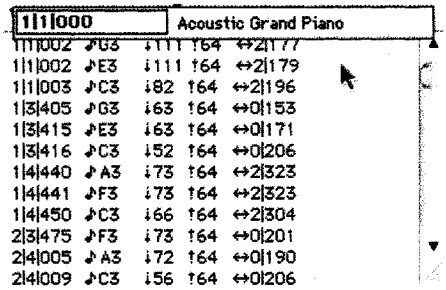

Fig. 2.27-Creating a Patch Change

Quantizing:

Another important form of editing in Digital Performer is Quantizing. Musicians generally do not play in perfect time. They play a little early or a little late, even against a metronome. This inaccuracy is what makes music sound alive. However, when playing into Digital Performer, the computer records these inaccuracies as they are played. At the end of the Control Panel window (see Fig. 3) is a series of buttons (Fig. 2.28).

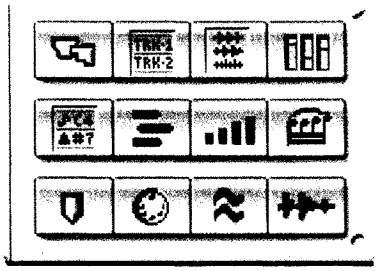

Fig. 2.28-Various Buttons Available

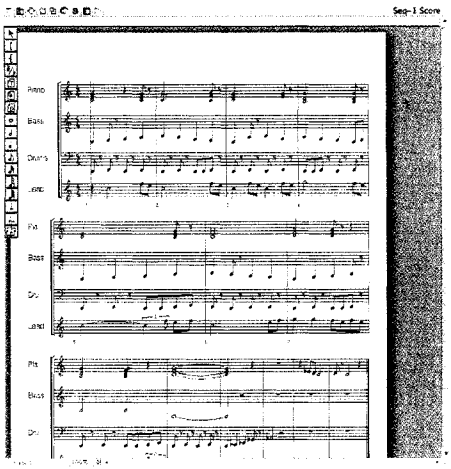

Fig. 2.29-Quickscribe View

- Clicking the Quickscribe button (middle row on the right in figure 2.28, appears as music notes), Digital Performer will open a notation view of the project (Fig. 2.29). The user may find that some of the notation is awkward; perhaps a 1/32 note tied to a quarter note to designate a note played just a hair early. While this sounds great, it is not how a user might want to notate the section.
- Clicking Region in the menu bar and scrolling down to Quantize (Fig. 2.30) will open the Quantizing window (Fig. 2.31). Quantizing allows the user to select the smallest note value in a section and Digital Performer will adjust all of the notes to line up at that value, eliminating early or late entrances. While this makes the notation appear perfect for exporting, it also looses the human feeling of the recorded track.

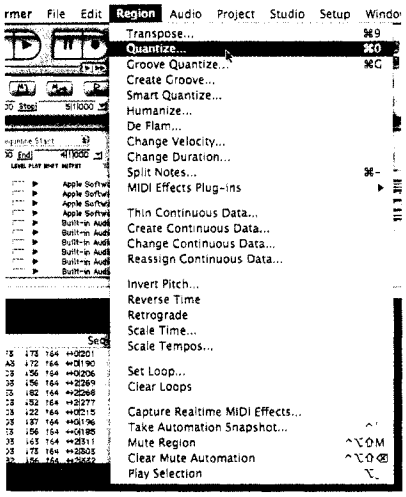

Fig. 2.30-Selecting Quantize

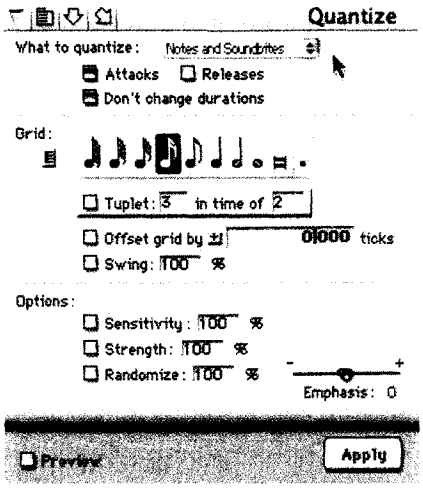

Fig. 2.31-Quantize Window

- Quantizing can be especially useful on any recorded track to insure synchronization of a performance. If the drum track is recorded early in the recording process, it can be a replacement for the metronome sound that can sound monotonous after a while.

Step Recording:

Rather than quantizing an existing track to make its sound be exactly on a beat, users have the option in Digital Performer to enter notes at specific values using the Step Record function. This option can be found in the Studio Menu (Fig. 2.32), or using the shortcut ⌘8.

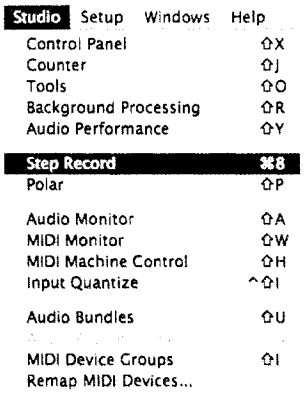

Fig. 2.32-Selecting Step Record

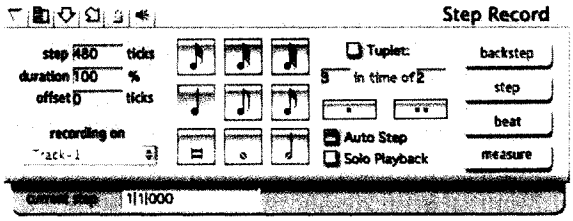

Fig. 2.33-Step Record Window

- Selecting Step Record opens a new window (Fig. 2.33) with all the controls for step recording.
- In this recording mode, specific note values are chosen in the Step Record Window and are applied when a note or chord is played on the MIDI keyboard. No matter how long or short the note is held on the keyboard, the resulting recorded notes will only be as long as the value set in the Step Record Window.
- The velocity information, how hard or soft the keys are pressed, is also recorded unless specifically disabled, so how you play the note is important.
- Rests can be entered by using the Step button, in the Step Record Window, which will advance the recording without inputting any pitch information.
- The Step Record Window also includes a button for creating tuplets and dotted notes. One other feature available in the Step Record window is an Offset. The Offset allows the user to build in some humanistic feel by inputting either positive or negative numbers to move the input note slightly late or early.
- As in the notation programs, Digital Performer also allows the user to use the keyboard number pad, which mimics the Step Record windows controls (Fig. 2.34).
- Step recording is a good option for those instances when inputting music from a score that requires the results to be exact or when the music is too difficult to be played by the user.

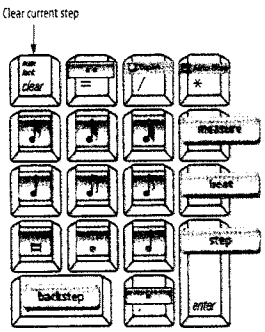

Fig. 2.34-Step Record Controls

Loops:

Another tool available in Digital Performer is the Loop. Looping gives the user the ability to create a section of music and have it repeat a pre-determined number of times (or indefinitely). Creating a loop with Digital Performer is a simple process.

- Double clicking the track opens the Event List window.
- Clicking the I (insert) drops down the Insert Menu. Scroll down to Loop (Fig. 2.35).
- A Loop will appear in the Events List (the top of Fig. 2.36), in this case, starting at measure 1, beat 3, 150 ticks (ticks are DP's smallest measurement of time), and ending at measure 3, beat 3, 224 ticks, repeating 6 times.

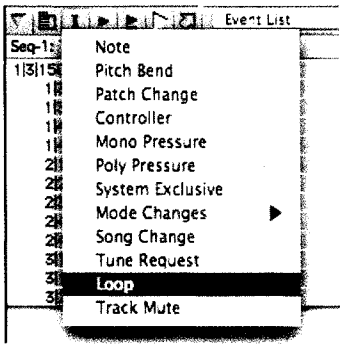

Fig. 2.35-Selecting Loop

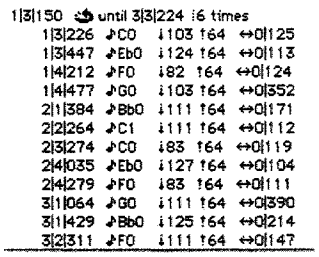

Fig. 2.36-Insterted Loop

- In the main sequence window (Fig. 2.37a), the track shows that it has a loop inserted because the Loop Indicator on the left side of the track is highlighted and, after the section being looped, there is a section marked by horizontal bars. Loops are great for creating a repeating chord progression to practice against or for creating a piece that has a line that does not change for a large space of time.

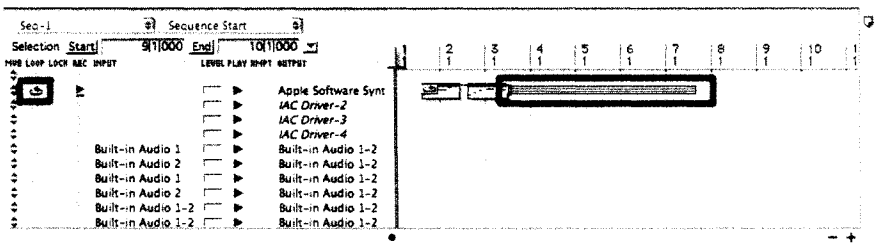

Fig. 2.37a-An Inserted Loop

One final capability in Digital Performer is its ability to be used for scoring movies and television. While conventional music is scored using a meter setting to control time, movies and television use a different sort of time coding called SMPTE, short for the Society of Motion Picture and Television Engineers. SMPTE uses numbers to represent time in movies, "for example, 01302015, would locate a frame 1 hour, 30 minutes, 20 seconds, and 15 frames into the film."[15] In Digital Performer, clicking the Setup menu and scrolling down to Time Formats (Fig. 2.37b), opens the Time Formats window (Fig. 2.37c), allowing the user to select from the various time formats available, including SMPTE.

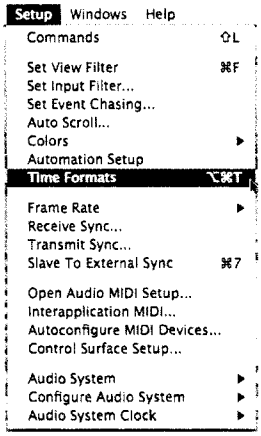

Fig. 2.37b-Selecting Time Format

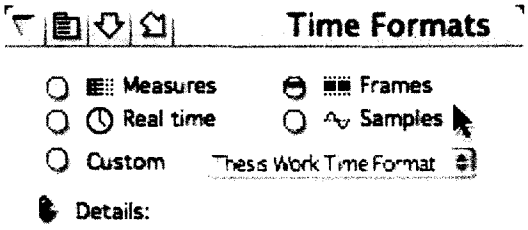

Fig. 2.37c-Time Format Window

[15] David Brian Williams and Peter Richard Webster, *Experiencing Music Technology* (Belmont, CA: Wadsworth Group/Thomson Learning, 1999), p. 397.

GarageBand

While Digital Performer is a professional level sequencing program, GarageBand is another in Apple's line of entry level programs designed to be extremely user friendly and to give "would be" sequencers an easy way to write music. It is not in the same league as Motu's Digital Performer, but it is a simple, inexpensive way to start exploring the world of sequencing.

- After launching Garage Band, the user is presented with a basic opening screen (Fig. 2.38), allowing the choice between creating a New Project or opening an Existing Project.

Fig. 2.38-Opening GarageBand[16]

- Clicking Create a New Project opens a second window (Fig. 2.39) with choices for key, time signature, and tempo. This window also allows the user to choose a name for the project and the place where it will be saved. Once the necessary choices have been made, clicking Create finishes the set up process.

[16] Screen shots reprinted by permission from Apple Computer, Inc.

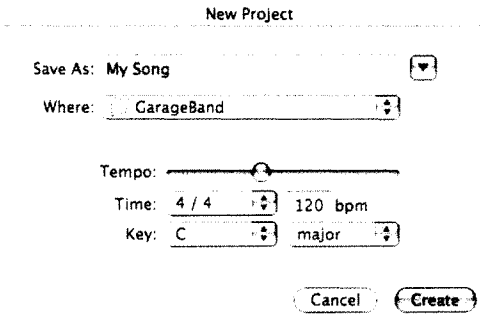

Fig. 2.39-New Project Choices

- The user is now presented with the main work screen (Fig. 2.40).

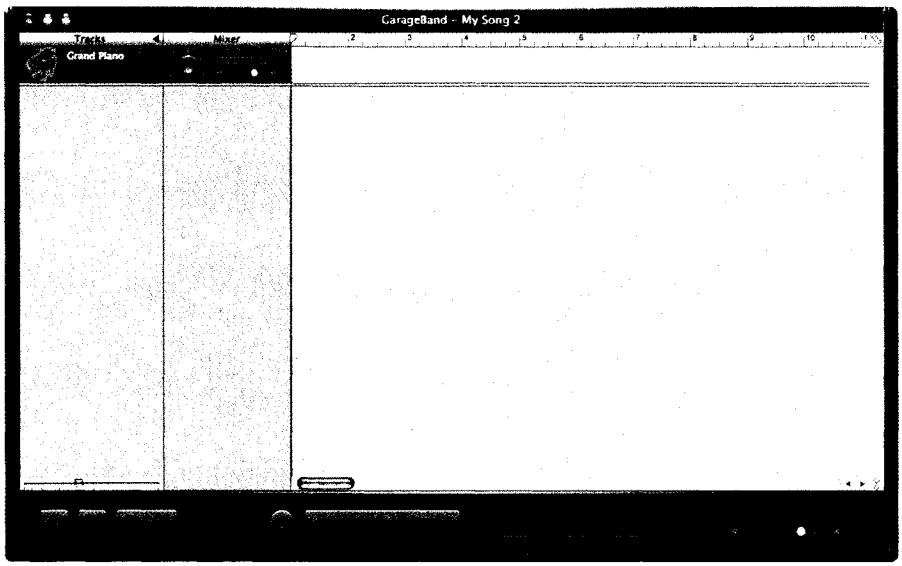

Fig. 2.40-Main Work Screen

Basic Controls:

Given the simple nature of Apple's basic programs, the main screen keeps clutter to a minimum and gives only the necessary controls.

- Looking at the top of the screen (Fig. 2.41), one finds the basic controls for the individual track. From left to right: Enable or Disable Recording (for this track), Mute, Solo (pressing play with this active will only allow this track to play), Lock

(keeps the track from being edited any further), Show Track Volume or Pan (the small downward facing triangle), Left and Right Panning, and Track Volume.

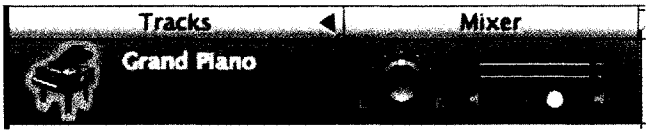

Fig. 2.41-Basic Controls

- Double Clicking either the image of the piano or the name Grand Piano, opens the Track Info window, which allows choice of instruments (Fig. 2.42) or changes in key or tempo (Fig. 2.43).

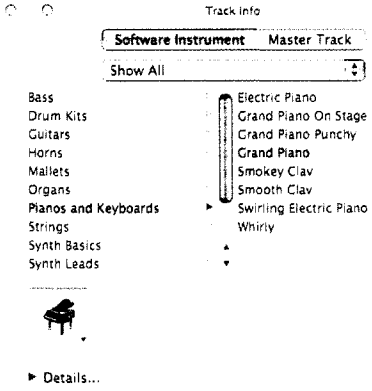

Fig. 2.42-Instrument Choices

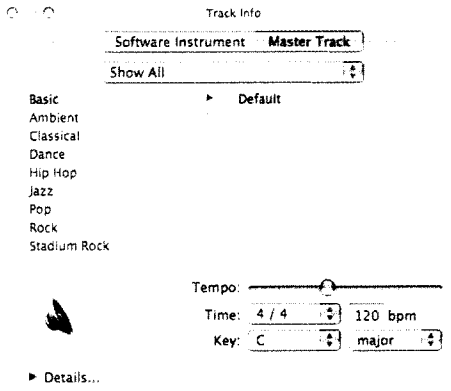

Fig. 2.43-Style Changes

- The bottom of the main window (Fig. 2.44) contains the controls for the entire project. From left to right: Add Track (+), Open Track Info window (i), Open Loop Browser (eye), Open Track Editor (scissors), Record, Return to Beginning of the Song, Rewind, Play/Pause, Fast Forward, Cycle Region (arrows following each other, loops a section of the song while activated), Counter, Tempo, and finally, the Volume Slider.

Fig. 2.44-Project Controls

- As in Digital Performer, GarageBand includes a metronome and count in, but rather than put them on the main screen, they are found under the Control Menu (Fig. 2.45). In GarageBand's case, the count in is only one measure long, rather than two. The user can turn the metronome on and off using the keyboard shortcut ⌘U.
- Clicking the record button will now initiate the recording process.

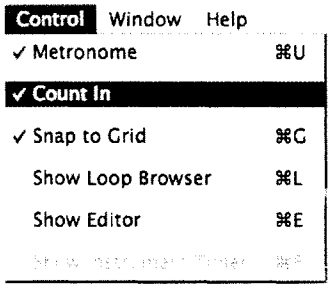

Fig. 2.45-Count In

Adding Tracks:

- The user may add new tracks in three ways. The simplest is to use the + button in the main window. Alternatively, there is a track menu (Fig. 2.46), which includes New Track. Notice that there is a shortcut listed next to New Track, which is ⌥⌘N (⌥ represents the Option Button) and is the third method for adding a track.

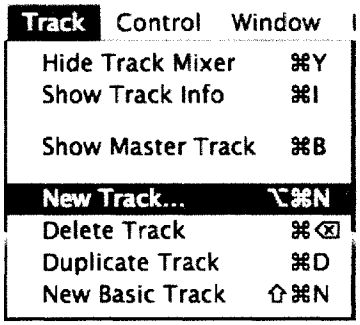

Fig. 2.46-Adding a New Track

- The user can continue to add tracks until the desired sound has been created. It is important to remember that Garage Band is capable of having multiple tracks using the same sound. This is helpful when creating complex parts, like the drum line (Jazz

Kit) (Fig. 2.47), enabling the user to concentrate on one aspect of the instrument, i.e. the snare part.

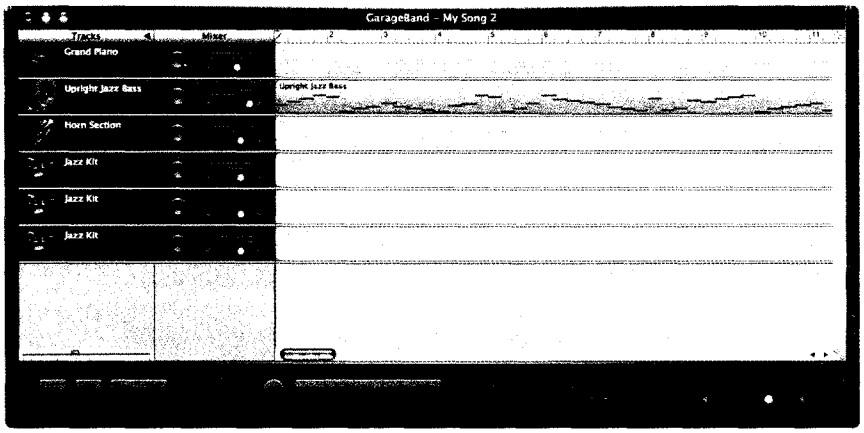

Fig. 2.47-Multiple Drum Tracks

Editing:

- Once music has been recorded, the main window will graphically show the recorded information. Double clicking any of the recorded parts will open the Editor window (Fig. 2.48). The Editor can also be opened from the Control Menu (Fig. 2.45) or with the shortcut ⌘E. With the Editor open, the user has the ability to go back through the recording and change any mistakes or omissions.

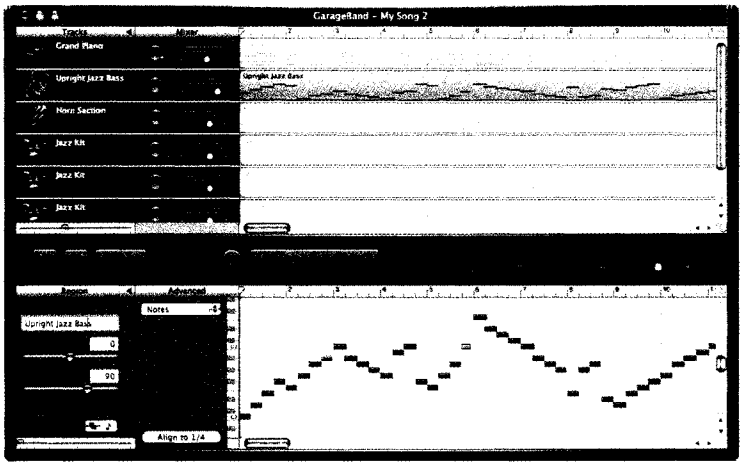

Fig. 2.48-Editor Window Opened

Quantizing:

As mentioned with Digital Performer, people are not perfect at playing in time. They play a little early or a little late and that imperfection breathes life into music. Sometimes it is desirable to have a part placed (quantized) exactly in time and there is a way to quantize (called Align in GarageBand) parts.

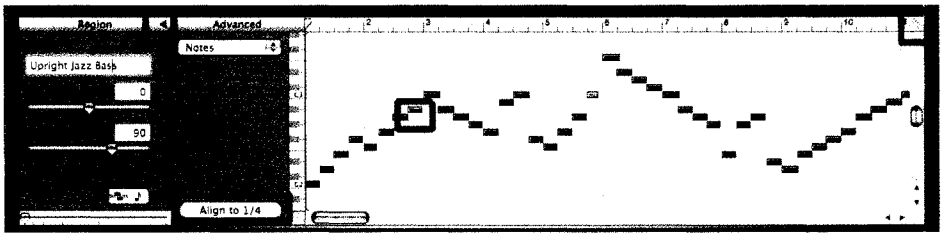

Fig. 2.49-Parts of the Editor Window

- Looking at the Editor (Fig. 2.49), there are a few things to notice with relation to aligning.
- First, the Advanced window must be open to make aligning available. (Next to the word Region is a small triangle that opens and closes the Advanced window.)
- Next, the user must select a note or series of notes to be aligned. The selected note will change color to red.
- Clicking on the little ruler in the upper right hand corner of the Editor window, will open the Timeline Grid Menu (Fig. 2.50), which allows the user to select the note value to which the notes should be aligned.
- Finally, clicking the "Align to . . ." button in the Editor will move the notes to their appropriate time location.

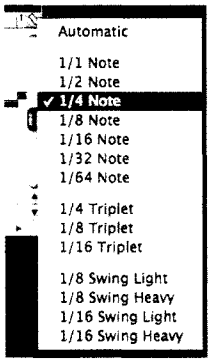

Fig. 2.50- Selecting Align To Note Value

Loops:

One aspect of GarageBand that makes it especially easy for beginning users is the use of loops. Loops, in GarageBand, are pre-recorded chunks of music that can be inserted into the recording project.

- As mentioned earlier, the Loop Browser (Fig. 2.51) can be opened by clicking the "eye" button in the main control area of the main window. It can also be opened through the control window (Fig. 2.45) or with the shortcut ⌘L.

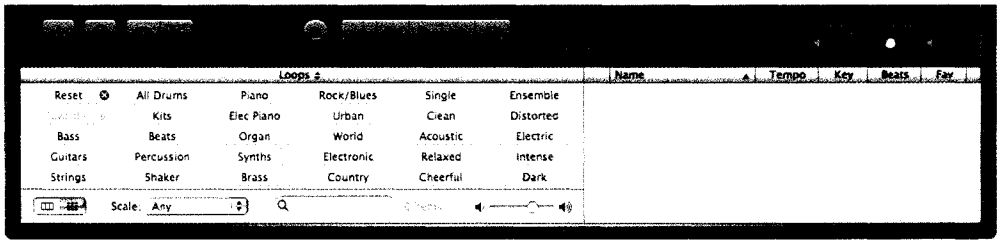

Fig. 2.51-Loop Browser

- Clicking any of the buttons in the Loop Browser will open a list of available loops attached to the button pressed (Fig. 2.52). Each loop is listed by name, with its Tempo, Key, and the number of Beats that the loop encompasses.

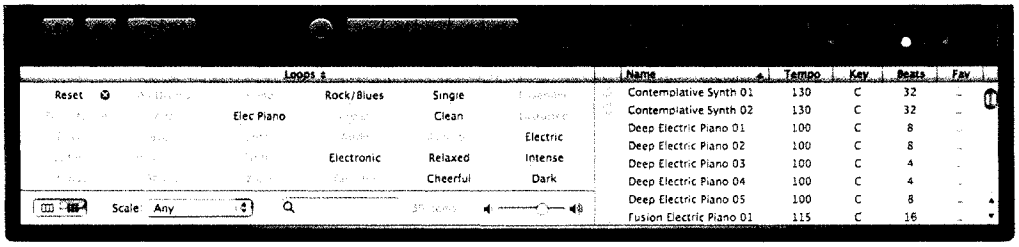

Fig. 2.52-Electric Piano Loops

- By choosing loops with matching keys and tempos, a user can create a basic tune using only loops.
- If a user wishes to create a loop in a piece of music, all that is necessary is to move the pointer to the upper right corner of the region to be looped. When in the appropriate spot, the cursor will change to a circular arrow (Fig. 2.53).
- Simply click and drag the cursor to the right and a loop will be created.

Fig. 2.53-Creating Loops

Keyboard Entry:

While GarageBand was designed to be used with a MIDI keyboard, it is also possible to use the program using only the computer keyboard.

- From the Window menu (Fig. 2.54), select Musical Typing.
- Garage Band will open the Musical Typing control window (Fig. 2.55), which shows all of the controls available on the computer keyboard.

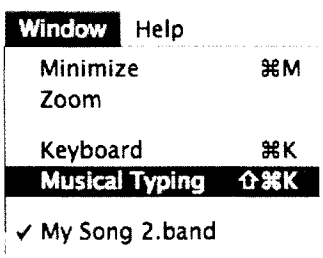

Fig. 2.54-Musical Typing

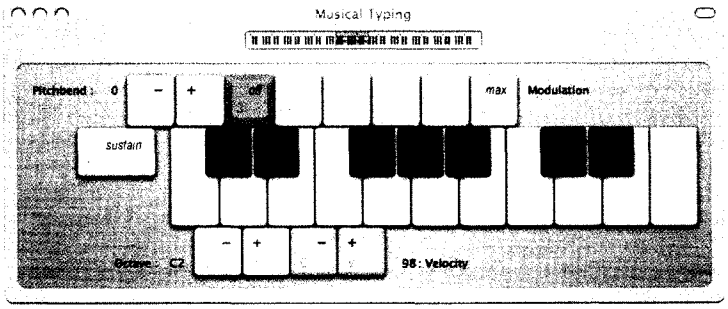

Fig. 2.55-Musical Typing Keyboard

Learning to use sequencers can be one of the most enjoyable areas of music technology to explore. It gives students the opportunity to be creative and write their own music. There are some people who believe that they cannot write music and are troubled by being required to "compose" something for a class. It is important to remember that music technology is not a composition class and that the process of creating music in this situation is just for fun and exploration. The compositions created are an avenue to find out what the programs introduced are capable of doing. The journey of creation is the important part, not the final composition.

Chapter 3

CAI: Computer Aided Instruction

One of the broadest areas of music technology is Computer Aided Instruction (CAI). While most software categories covered in this course are very specific in their use and presentation, CAI software ranges in focus from young children to adults and covers the full range of music. Computer programs designed for music instruction do not replace traditional education methods, but they are a helpful resource. In order to examine the world of CAI, it is best to separate the software into several categories: 1) Children's Software, 2) Instrumental Software, 3) History/Style and Practice, and 4) Theory and Ear Training. Note: Some software could be included in multiple categories, however, in this text they will be listed by their most predominant attribute. This chapter will not try to examine all the software on the market, but rather introduce examples of each type and give resources for further exploration. One aspect of CAI that will be excluded is web-based, non-interactive education; i.e. Web sites designed just to be read for instructional purposes. Web sites that include interactive instruction will be included.

Children's Software:

Music programs designed for children are a wonderful addition to traditional teaching methods. Most children in today's world are computer literate and "play" with computers on a regular basis, so finding a piece of software that appeals to them as a computer game can be a great tool for assisting a teacher.

One program that has consistently been a top seller for children's CAI is Music Ace (Figs. 3.1 & 3.2) by Harmonic Vision (http://www.harmonicvision.com). Music Ace

offers thirty-six lessons that cover everything from note name and staves to scales and time signatures, in a game-play format.

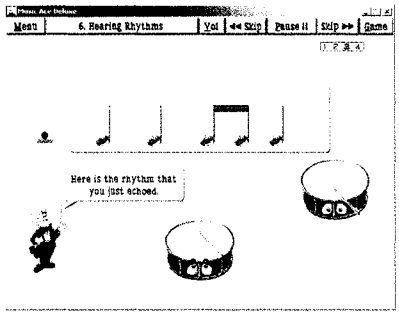

Fig. 3.1-Music Ace[1]

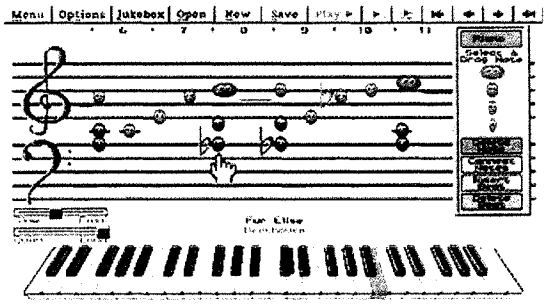

Fig. 3.2-Music Ace

Don Bowyer, the Director of Jazz Studies and Music Technology at the University of Alabama, at Huntsville, developed his own music program for kids entitled Dolphin Don's Music School (http://www.dolphindon.com) (Figs. 3.3 & 3.4). This software is designed to teach students music theory and ear training and is listed as being, "Suitable for all ages from 6 through adult, Dolphin Don' Music School starts at the beginner level and continues to college music theory material."[2] As with Music Ace, Dolphin Don's Music School is best suited for young children given its cartoon style, game based design.

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[1] Music Ace screen shots courtesy of Harmonic Vision, Inc.
[2] Don Bowyer, Dolphin Don's Music School, (2002).
<http://www.dolphindon.com/intro.html>

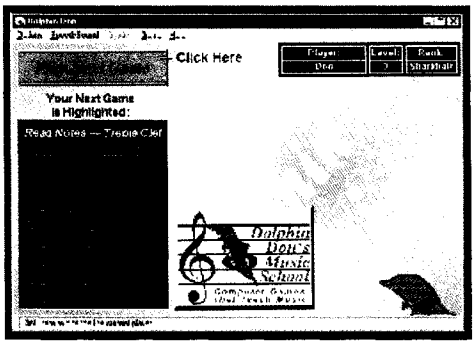

Fig. 3.3-Dolphin Don's Music School[3]

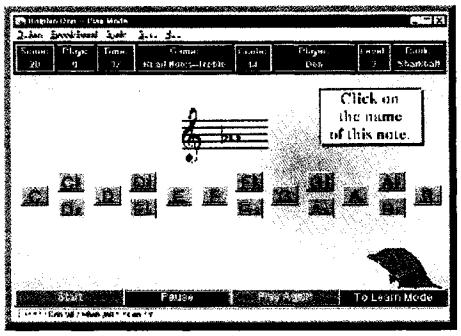

Fig. 3.4- Dolphin Don's Music School

There are many resources available on the web for finding more children's software titles. Two extensive retail sites to start with are:

ECS Media (http://www.ecsmedia.com)

Lentine's Music (http://lentine.com/onlinecatalog/SO/MDS.htm)

Instrumental Instruction:

Software is also available for students wishing to practice their instruments with the aid of a computer program. Programs are available for a wide range of instruments and in a variety of formats.

EMedia (http://www.emediamusic.com) has produced several instructional programs for guitar and electric bass. eMedia Guitar Method teaches guitar through lessons based on popular and classical music, showing music in both guitar tablature (Fig. 3.5) and standard music notation (Fig. 3.6). It demonstrates chords in video format (Fig. 3.7), virtual fret board (Fig. 3.8), and includes a chord calculator (Fig. 3.9).

[3] Dolphin Don's Music School screen shots courtesy of Don Bowyer.

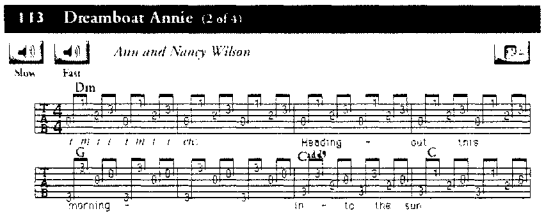

Fig. 3.5-eMedia Guitar Method Tablature[4]

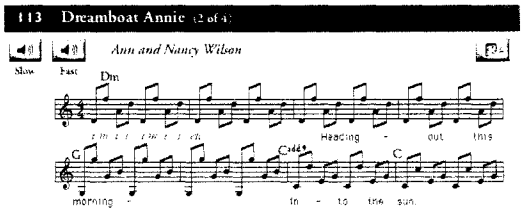

Fig. 3.6- eMedia Guitar Method Standard Notation

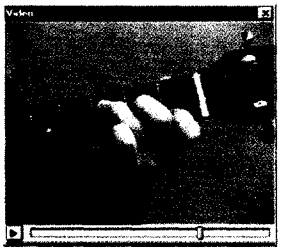

Fig. 3.7-eMedia Video Lesson

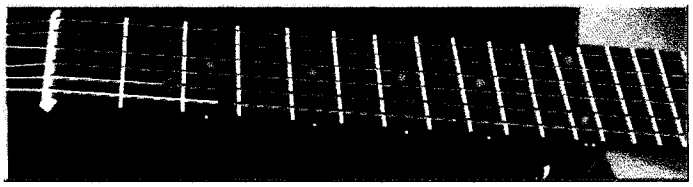

Fig. 3.8-eMedia Virtual Fretboard

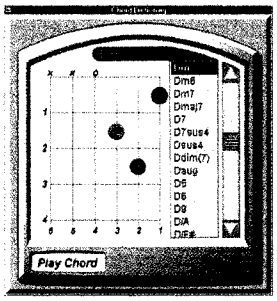

Fig. 3.9-eMedia Chord Calculator

Band-In-A-Box (Fig. 3.10) produced by PG Music (http://www.pgmusic.com), is another instrument based music program. This software was designed by Dr. Peter Gannon to create play-along music. By simply typing in chords, Band-In-A-Box will automatically create music in a variety of styles and melody lines can be added if desired.

[4] eMedia Guitar Method screen shots courtesy of eMedia, Inc.

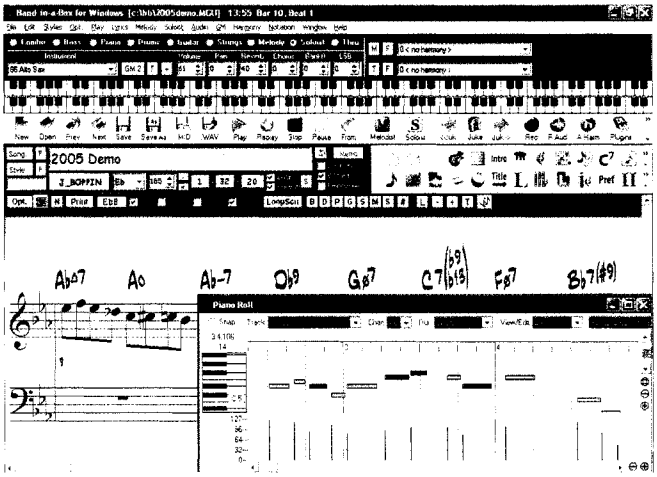

Fig. 3.10-Band-in-a-Box Main Screen[5]

History/Style and Practice:

Programs designed to teach students history generally are CD-ROM based, meaning they are created as interactive books.

One such example is Switched on Sound: Movements in 20th Century Music from Duke University (http://www.tip.duke.edu/) which teaches students about the changes in music in the 20th Century from John Cage to rock and roll. Through a combination of written, aural, and video sources, the CD-ROM allows the student to choose what areas he or she would like to investigate (Figs. 3.11 & 3.12). CD-ROM's available from Clearvue include Art & Music: The Renaissance (Fig. 13) and The History of Music (Fig. 14).

[5] Band-in-a-Box screen shot courtesy of PG Music, Inc.

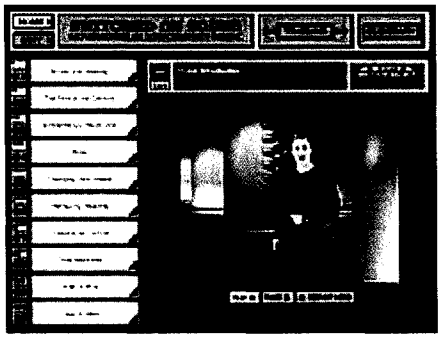

Fig. 3.11-Switched on Sound Video[6]

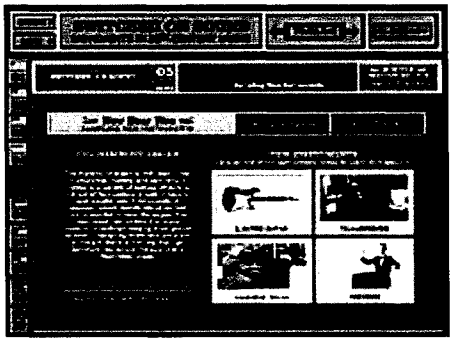

Fig. 3.12-Switched on Sound History

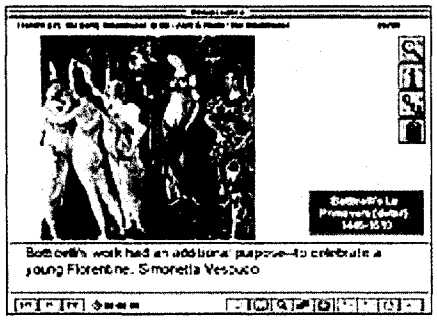

Fig. 3.13- Art & Music: The Renaissance[7]

Fig. 3.14.-The History of Music

Theory and Ear Training:

One of the largest groups of available CAI programs is in the theory and ear training group. There are a large number of ear training web sites and amateur and professionally produced software.

On the web, there are a few resources with a large listing of programs designed for ear training.

Music Software for Eartraining – Douglas Spangler's Master's Thesis examining the various pieces of software available. It was last updated in 1999, so some of the information is out dated, but it is very comprehensive.

http://www.msu.edu/user/spangle9/index.html

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[6] Switched on Sound screen shots courtesy of Duke University, TIP
[7] Art & Music screen shots courtesy of Clearvue & SVE

Hit Squad Music Network – A great online resource for music software with listings for all platforms.

http://www.hitsquad.com/smm/cat/EAR_TRAINING/

Harmony-Central – A top resource for electronic music, guitar, bass, drums, and software information and links.

http://www.harmony-central.com/Software/

Lentine's Music – A commercial music store with a large selection of software.

http://lentine.com/onlinecatalog/SO/LPS.htm

Web-based, interactive training is also available on a number of websites. This format of training is somewhat limited by Internet connection speed and web browser capabilities. The sites listed are all free.

Musictheory.net - Ricci Adams created one of the best and most comprehensive groups of online lessons and trainers (Fig. 3.15). It includes lessons on theory, including notes, key signatures, intervals, chords, and scales. He also created interactive trainers for theory and ear training (Fig. 3.16). Additionally, the site contains a piano chord calculator, a staff paper generator, and a tone row matrix generator.

http://www.musictheory.net

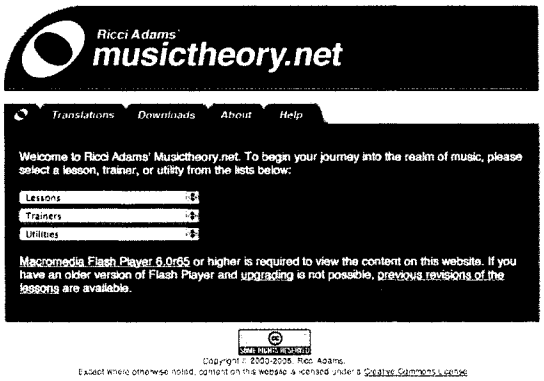

Fig. 3.15-MusicTheory.net [8]

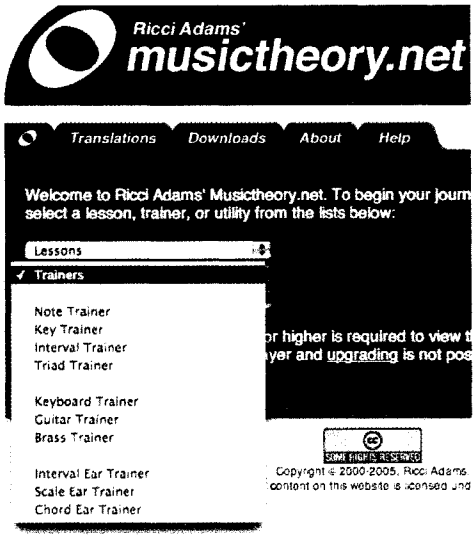

Fig. 3.16-MusicTheory.net Trainers

eMusicTheory.com – Robert Whelan's website, begun while he was a student at Hamilton College (Fig. 3.17). It includes a few interactive theory trainers. **http://www.emusictheory.com/**

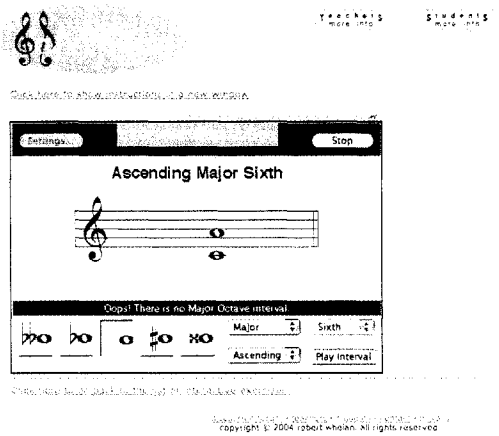

Fig. 3.17-MusicTheory.com Interval Training

Good-Ear.com – Martin Schoeberl's interactive ear training web site (Fig. 3.18). His trainers include intervals, chords, scales, jazz chords, and note identification and are fairly comprehensive. **http://www.good-ear.com/**

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[8] Courtesy of Ricci Adams

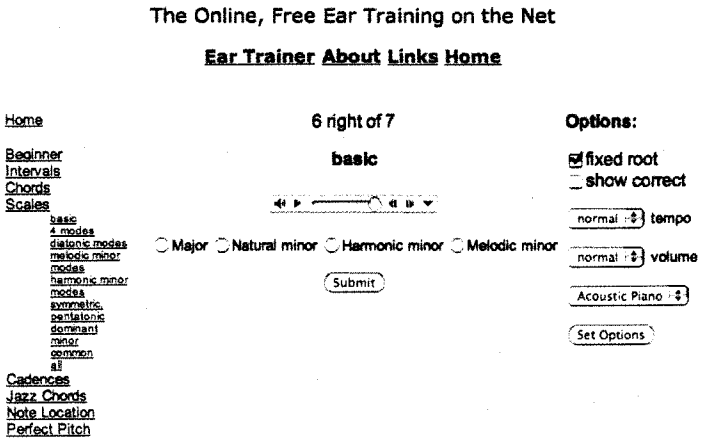

Fig. 3.18-Good-Ear.com Interval Training

Big Ears – Michael Ossmann's interactive interval trainer (Fig. 3.19).

http://www.ossmann.com/bigears/

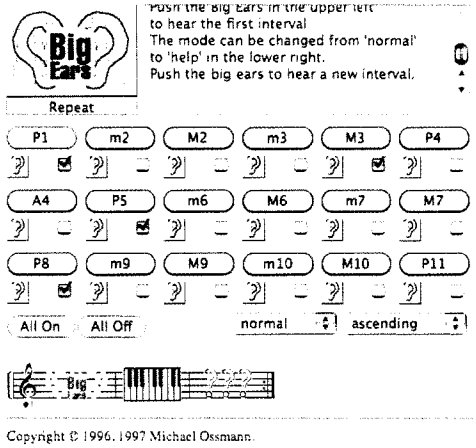

Fig. 19-Big Ears Interval Training

There are a number of commercially available ear training programs, including MacGamut (http://www.macgamut.com), Ear Master 5 (http://www.earmaster.com/), and Auralia (http://sibelius.com/products/auralia/). One of the most widely used commercial software ear trainers is Practica Musica by Ars Nova. Practica Musica allows students to create their own user file to keep track of their progress. The program contains a simple interface with a music window (Fig. 3.20) and keyboard/answer window (Fig. 3.21).

From the Activities Menu (Fig. 3.22), students choose the area they would like to train in and then select a training level from the Levels Menu. Practica Musica's levels increase in difficulty as the student progresses. It is MIDI capable, so students can connect to any MIDI device to broaden the sound palette available for listening. The newest version also allows users to customize trainers to work on problem areas and can recognize sounds when used with a USB microphone, to allow sight singing training.

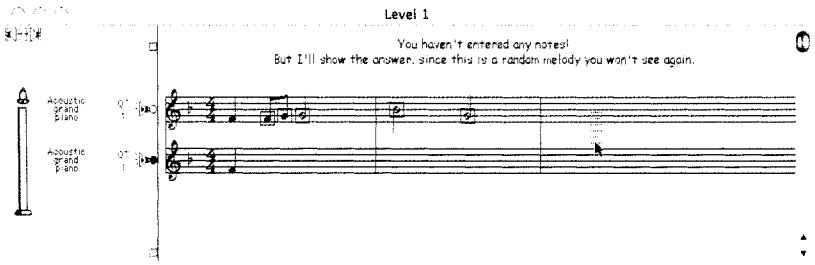

Fig. 3.20-Practica Musica Dictation[9]

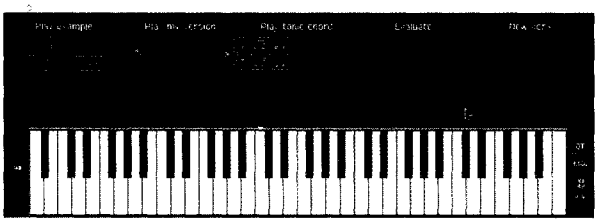

Fig. 3.21-Practica Musica Keyboard and Note Input

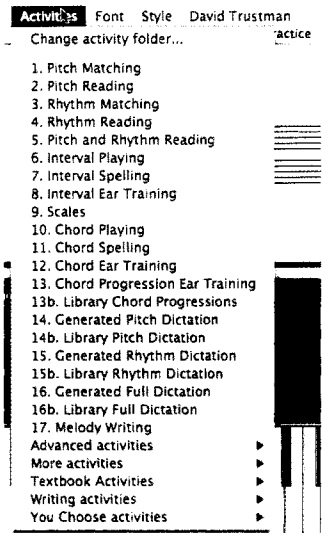

Fig. 3.22-Practica Musica Activities List

CAI software is constantly evolving, becoming better able to serve music students in ways that support their education. Used correctly, it can be a great addition to any

[9] All Practica Musica screen shots used by permission from Ars Nova Software

music education program, from elementary school through university. Students should be encouraged to investigate all of the possibilities of CAI software.

Chapter 4

The Web

The Internet has become an integral part of our society. Children raised in our society today would find it hard to imagine a world without the Internet. What began as a way to link university computers at UCLA, Stanford, UCSB, and the University of Utah in 1969, has blossomed into the World Wide Web that we know today[1]. In the mid 1980's, three companies pioneered public networking. CompuServe, Prodigy, and America Online were not Internet connections, but rather privately created networks that individuals could join and use to communicate.[2] Those companies developed software in an easy to use, user-friendly package that made the transition to the UNIX based Internet easy for lay computer novices. One of the major explosions in Internet use came with Netscape Communications release of its web browser and Microsoft's subsequent introduction of Internet Explorer. These pieces of software allowed anyone to pay for an Internet connection and be able to "surf the web" without AOL's or CompuServe's proprietary software. Eventually, AOL bought CompuServe and Internet Explorer pushed Netscape into relative obscurity, but the Internet's popularity took off as companies like Earthlink and SBC rode the Internet wave.[3] The Internet today is an invaluable tool for conducting research on almost any topic, but with the good also comes the bad. Some might think the bad is pornography and spam, but one of the real problems that exist on

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[1] Barry M. Leiner, et al., "A Brief History of the Internet," (2003) <http://www.isoc.org/internet/history/brief.shtml>.
[2] Christos J.P. Moschovitis, et al., *History of the Internet,* (1999) <http://www.historyoftheinternet.com/chap5.html>.
[3] Ibid.

the web is the ability for anyone to create a web page on any subject, thus making it difficult to discern what is quality, reliable information and what is biased or false. It is important, as college students, to dig through a web site to find who has created the web site being read and what their qualifications are in regard to the subject they are presenting. This can prove difficult at times.

A case in point: In doing research for this section, a search at Google.com for "Internet History," which yielded about 353,000,000 results. Near the top of the list was "A Brief History of the Internet,"[4] which seemed like a good start. The information seemed fairly accurate to me, but only listed the author, Walt Howe, not his qualifications. I had to navigate through a few of his pages to find he had listed himself as "Author of *Internet Basics*, one of the early (1993) Internet books, with Steve Lambert. Formerly a cryptanalyst, cryptanalysis trainer, signals intelligence training developer, and training director for the US Army Security Agency Training Center & School (later the Fort Devens branch of the US Army Intelligence School) for 32 years at Fort Devens, MA, before it moved to Fort Huachuca, AZ. (I started searching worldwide nets years ago--long before there was an Internet.) Author of the Army's Field Manual 34-40-2, Basic Cryptanalysis. The book has been republished commercially by Classical Crypto Books. Member of the Internet Society."[5] Even reading this, it would take more digging to decide if the information Mr. Howe presented, including his credentials was accurate.

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[4] Walt Howe, "A Brief History of the Internet," <http://www.walthowe.com/navnet/history.html>.
[5] Walt Howe, "All About Walt," <http://www.walthowe.com/aboutme.html>.

Given the difficulty in finding reliable information on the web, it is best to start Internet research through a university. In many instances going through a university's library web site yields some excellent links to quality web sites.

Non-Academic Web Sites:

Initiating a Google.com search for Music yields 1,700,000,000 sites. Narrowing the search to Music Technology lowers that to 365,000,000. Listed below are a few selected web sites that contain information and links that could prove useful in music technology research. None of the sites listed are academic in nature and the information listed is not guaranteed to be accurate.

Harmony-Central – Industry links, Forums, Software Downloads – **http://www.harmony-central.com/**

MusicMoz – "MusicMoz is a comprehensive directory of all things music, edited by volunteers. We list, and accept submissions of, music-related reviews, articles, factual information, biographies, and websites."[6] - **http://www.musicmoz.org**

Classical Net – The site is dedicated to classical music. The portion of the site listed here is its Classical Music Links/Music Schools, Libraries, Academic Links page. **http://www.classical.net/music/links/musiclib.html**

Synth Zone – "Synth Zone is an attempt to ease the search for synthesizer & electronic music production resources on the Internet."[7] This site contains a good selection of links. **http://www.synthzone.com**

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[6] -, *Musicmoz: The Open Music Project*, <http://www.musicmoz.org>.

MIDI Web – This is a good resource for information and links concerning MIDI. **http://www.midiweb.com/**

Web Creation Guides:

While web sites can be created using a number of programs like Microsoft's Front Page and Macromedia's Dreamweaver, a working knowledge of basic HTML (Hyper Text Markup Language) is very helpful. HTML is the written commands that make up a web site. To see any web page's HTML coding, Click the View menu in any web browser and scroll down to View Source. Any web page can be created using HTML code, without the help of the programs listed above and many seasoned and successful web designers use a basic text editor and an FTP (File Transfer Protocol) program to upload entire, large scale web sites to the Internet. Individuals interested in learning how to create web sites will find the following links to tutorial sites useful.

Web Monkey – This is a great web site with easy to follow tutorials on web page creation. **http://www.webmonkey.com/**

HTML Goodies – This is another well-organized, comprehensive tutorial site. **http://www.htmlgoodies.com/**

HTML: An Interactive Tutorial for Beginners – This site contains an easy to follow, basic tutorial. At the end of each chapter, students can input their own HTML code and test the results from within the web browser.

http://www.davesite.com/webstation/html/

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[7] -, *Synthzone*, <http://www.synthzone.com>.

Chapter 5

PowerPoint

Though PowerPoint is not a music-specific program, it is a useful presentation tool for all students. PowerPoint behaves like a slide show, giving presenters a tool to display text, musical examples, video images, and play audio files. It can be used in place of many other presentation tools, including overhead projectors, VCR's and DVD's, CD's, consolidating those functions into one program. It is simple to use and shares much of its functionality with Microsoft's Word program. While the program is a little different in the Mac and PC formats, both share most of the common features needed for a basic understanding of the program.

How to Begin:

Starting the program brings up a screen similar to Microsoft's Word program (Fig. 5.1), allowing the user to choose the type of document to be produced or open a previously created project.

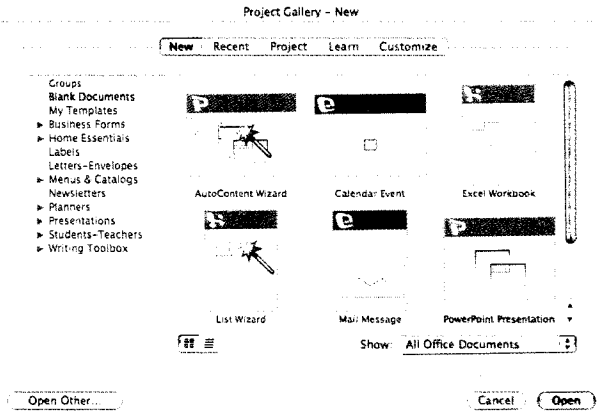

Fig. 5.1-PowerPoint Project Selection[1]

[1] Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation.

- Once a new PowerPoint Presentation has been selected, two main windows are opened, the Presentation Window (Fig. 5.2) and the Formatting Palette (Fig. 5.3).

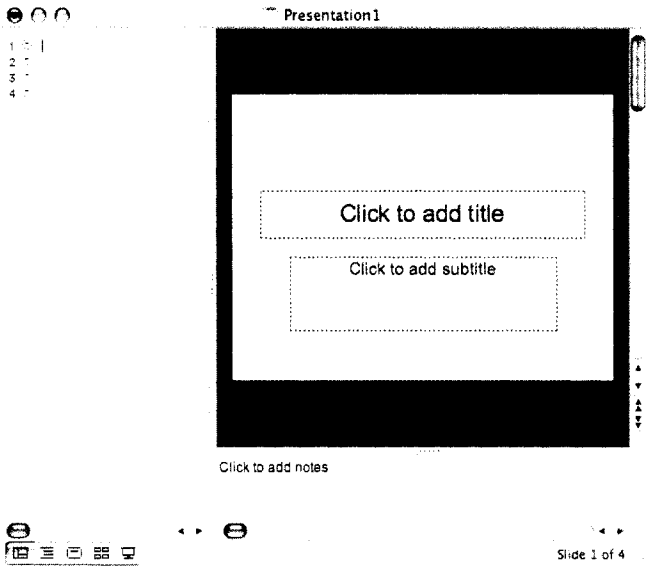

Fig. 5.2-Presentation Window

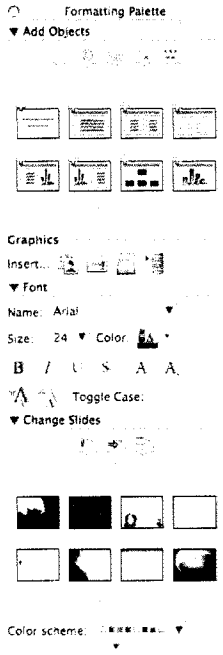

Fig. 5.3-Formatting Palette

- As can be seen in Figure 5.2, PowerPoint prompts the user to input the desired attributes for the page, i.e. "Click to Add Title," and "Click to Add Subtitle."

Adding a Slide:

- Clicking any of the available slide layouts in the Add Object section of the Formatting Palette (Fig. 5.3) will add a new slide after the one currently being created. There are pre-formatted slides with windows set up for blank slides, graphs, pictures, multiple text boxes, and video.

Once the content has been added to a slide, clicking on any text box or object on the slide will open new options in the Formatting Palette (Fig. 5.4), including Alignment and Spacing, Bullets and Numbering, Animation, and Hyperlink.

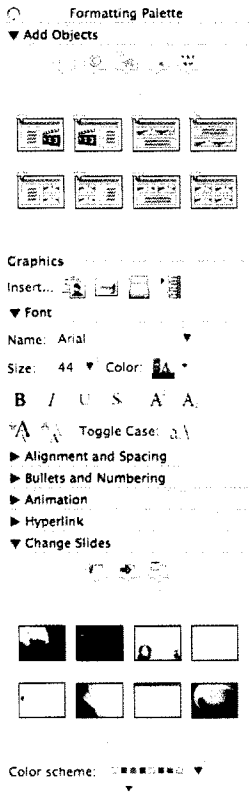

Fig. 5.4- Formatting Palette Expanded

Animation:

One of the most interesting additions to the Formatting Palette is the Animation Section.

- Clicking the arrow next to Animation allows the user to add animation to the slide (Fig. 5.5).
- Clicking the Customize Button (Fig. 5.5) opens the Custom Animation Window (Fig. 5.6), which allows the user to control all aspects of the animation process.

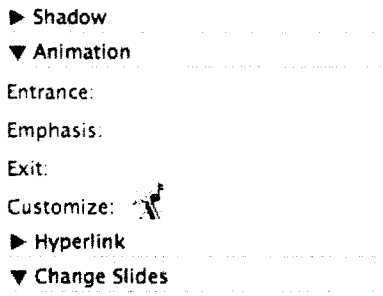

Fig. 5.5-Animation Selection

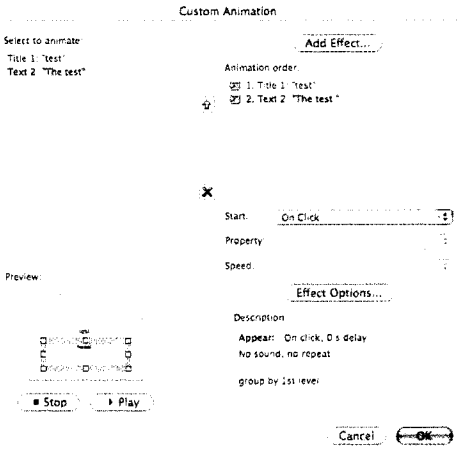

Fig. 5.6-Custom Animation

While animation can add a nice dimension to any presentation, having text enter as it is needed or making pictures appear as they are discussed in the presentation, users are cautioned not to over use this function. Even though there is a large list of possible effects to choose from in PowerPoint, it is advisable to only use one or two for all animations. It is also worth noting that in both television and movies, editors tend not to use many different effects to move between scenes, usually only one or two. Additionally, there are sounds that can be added to any animation, however these should be used sparingly, if at all, as they tend to be more annoying than effective.

Slide Design:

The entire slide show can be given a consistent background design by clicking on the Format menu and selecting Slide Design (Fig. 5.7).

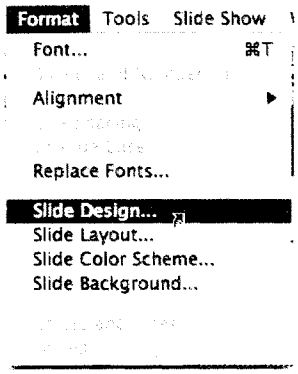

Fig. 5.7-Slide Design

- Selecting Slide Design opens the Choose Slide Design window (Fig. 5.8), which includes a list of pre-formatted backgrounds and color selections for the slide show.

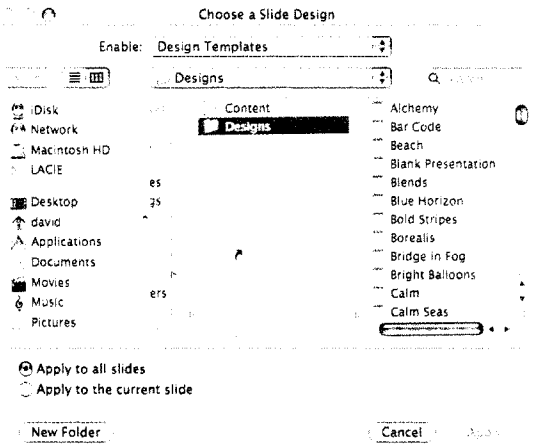

Fig. 5.8-Choosing Slide Design

Blank Slides:

A blank, black slide is a helpful tool to add to any slide presentation between active slides. Having a blank slide can give the presenter an opportunity to speak without any distraction facing the audience, as well as putting convenient pauses between slides. To create a black slide:

- The user selects a blank slide from the Formatting Palette (Fig. 5.9).

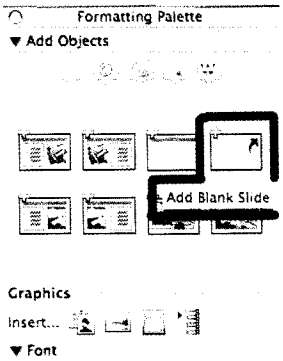

Fig. 5.9-Add Blank Slide

There are then two methods to create a black slide.

If the user has **not** used a Slide Design:

- Simply click on the Format Menu (see figure 5.7) and select Slide Background, which opens the Background Window (Fig. 5.10).
- Clicking the bar in the Background Fill window will open a sub-menu with color selections (Fig. 5.11).

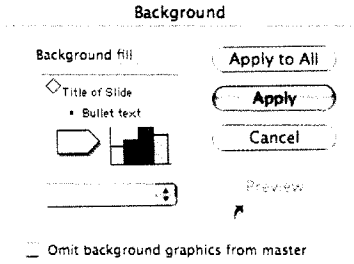

Fig. 5.10-Background Color Selection

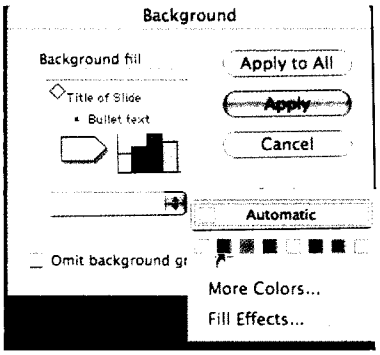

Fig. 5.11-Background Color Selection

- Selecting black and clicking the Apply button will change the selected slides background to black.

If the user **has** selected a Slide Design, the background is pre-set, so a different method is necessary (this method covers the existing background rather than replacing it):

- In the Formatting Palette, in the Add Objects section, the second button is Auto Shapes. Select Rectangle from Auto Shapes (Fig. 5.12).

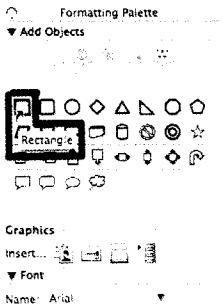

Fig. 5.12-Selecting a Rectangle

- The cursor is changed from an arrow to a plus sign.

- Click and hold the upper left corner of the slide with the cursor and drag the cursor to the lower right corner of the slide, releasing the click. This creates a colored rectangle. The rectangle appears with white boxes around its perimeter, which can be used to resize the shape if it does not completely cover the slide.
- If the rectangle is not colored black already, click on the Format menu and select Colors and Lines (Fig. 5.13), which opens the Format Auto Shape window (Fig. 5.14).

Fig. 5.13-Colors and Lines

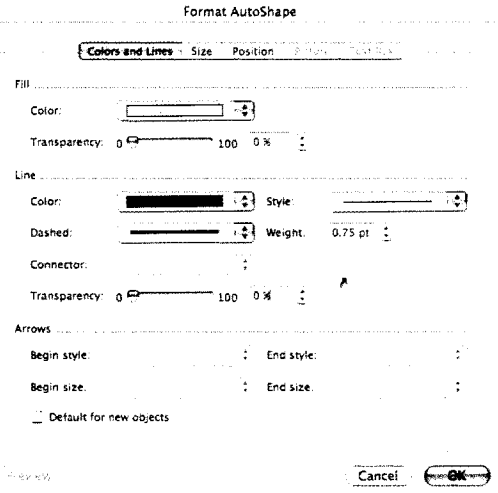

Fig. 5.14-Color Selection

- Clicking the bar in the Fill section of the window will open a sub-menu in which black may be selected.

Running the Slide Show:

Starting the slide show can be accomplished by clicking the Slide Show menu and choosing View Show (Fig. 5.15).

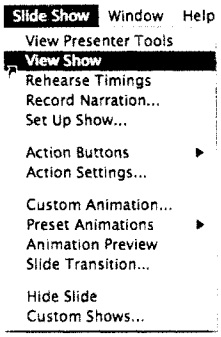

Fig. 5.15-View Show

- Each mouse click advances the show by one action, activating each animation or moving to the next slide.
- Video and audio clips may be set to run automatically or have controls appear in the slide to allow them to be started and stopped as necessary.

Slide shows should not be verbatim copies of what the presenter is speaking. Not only is it unprofessional to read from a slide, but it also draws the audience away from listening to the speaker and into reading the slide for himself or herself. An occasional full quote is an acceptable item to include in a slide.

Chapter 6

History

The study of the history of music technology can often seem tedious. Why look to the past? Well, put simply, the past leads to the present and guides the future. In the case of music technology, the past is not that far behind us and the changes in technology happen at an amazing rate. Most musical instruments have a long history of development. Even a recently developed "traditional" instrument, the saxophone, has a long historical background. The saxophone was not invented until 1841 by Adolph Sax, but shares the long history of the entire woodwind family. Electronic instruments and recording, on the other hand, have a comparatively short history. Thomas Edison created cylinder recordings for the first time in 1877 (Fig. 6.1) and though magnetic tape recording was invented in the 1930's, its widespread use did not occur until after World War II, in the 1950's. Reel to reel recording, cassette tapes, digital audio tapes, CD's, and MP3's, all stem from Edison's 1877 invention and their continual evolution speeds up as time passes. It took roughly 75 years to get from cylinder recording to tape recording and less than fifty to move from there to digital mediums. Imagine the changes to recording in just another 25 years.

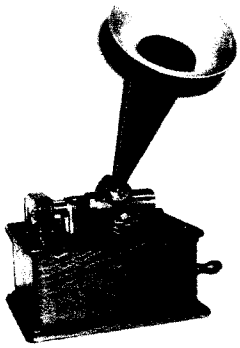

Fig. 6.1-Edison Cylinder Phonograph[1]

Some of the earliest examples of electronic music stem from the use of magnetic tape to create "new sounds."

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[1] Photo courtesy of Dwayne Wyatt, <http://www.wyattmusical.com>.

> The earliest significant developments took place in 1948 at the French National Radio, where the sound technician Pierre Schaeffer (b. 1910) began producing short tape studies based on transformations of "natural" sounds, such as those of a train or a piano. The transformational processes included editing out portions of the sound, varying the playback speed, playing the sounds backward ("tape reversal"), and combining different sounds ("overdubbing"). Schaeffer called this type of electronic music *musique concrète.*[2]

While this type of music was developed by Schaeffer, he would later be joined in this type of composition by Edgar Varèse, Pierre Boulez, Olivier Messiaen, and Karlheinz Stockhausen among others. With the coming of a new form of music, some composers chose to explore new ways to notate their music. Figure 6.2 shows one such study by Karlheinz Stockhausen, who was exploring sine waves in his music. This example, written in 1953, exemplifies the lengths to which composers had to go to incorporate the new areas of music.

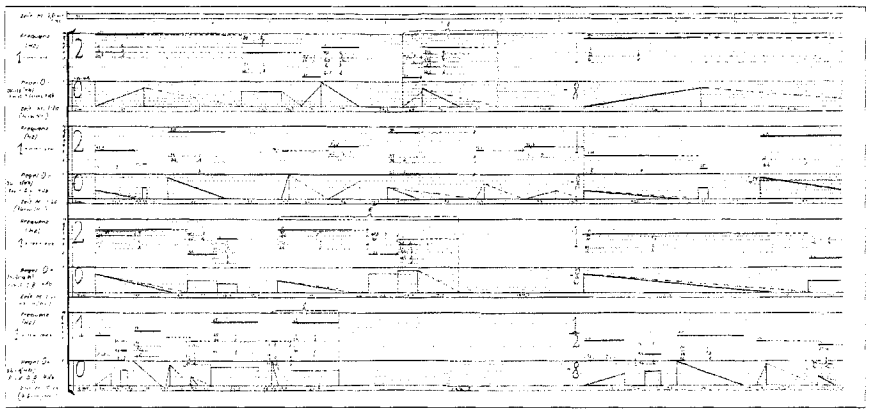

Fig. 6.2-Karlheinz Stockhausen Studie I[3]

[2] Robert P. Morgan, *Twentieth-Century Music,* (New York: W. W. Norton, 1991), pp. 463-464.

[3] Karlheinz Stockhausen, Studie I, 1953, © Karlheinz Stockhausen (www.stockhausen.org)

One form of recorded music experimentation that is still in limited use today is the tape loop. It was originated using reel to reel tape machines, this is an additive form of recording where, instead of having a tape that runs between reels on a single tape machine, artists would splice the tape together in one continuous loop and run it through several tape machines (Fig. 6.3 & 6.4). Each machine had the ability to play and record sounds as the tape advanced, so that the resulting recording could take on a life of its own, constantly adding sounds as it advanced. More recent experiments in this type of music have been done on digital recording units, which can mimic the effect of several tape machines in one recorder. Examples of looped music can be found from the studios of Robert Fripp, of King Crimson fame, and Brian Eno.

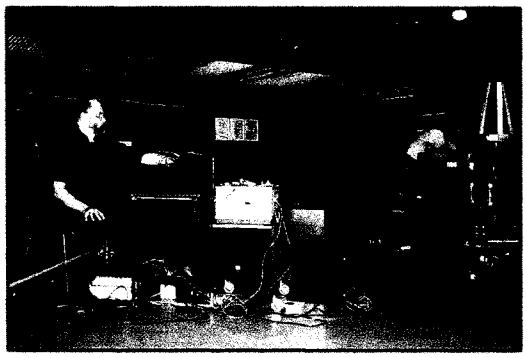

Fig. 6.3-Tape Looping[4]

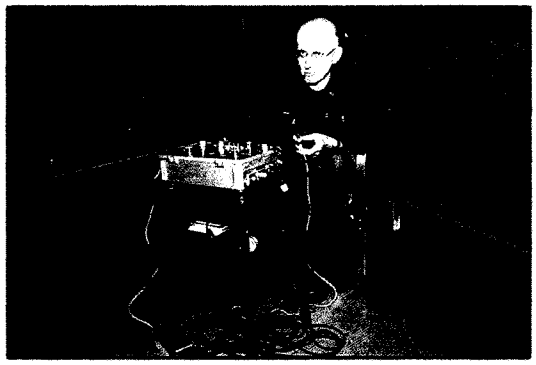

Fig. 6.4-Tape Looping

In terms of instruments, one of the earliest wholly electronic instruments is attributed to Leon Theremin (nee Lev Termen). His invention, the Theremin (Fig. 6.5), was the first instrument designed to be played without touch. The Theremin consists of two antennae, one for pitch and the other for volume, that the musician moves his or her hands in proximity to, creating sounds. The Theremin has enjoyed on again, off again

[4] Tape loop photographs courtesy of Ingvar Loco Nordin

popularity since its inception. In terms of early acceptance of the instrument, Clara Rockmore toured extensively playing the Theremin in concerts around the world play works by Bach, Stravinsky, Ravel, Rachmaninoff, and others.[5] The instrument has found popularity in movies as a sound effect for science fiction films and has had some use in pop music by Led Zeppelin's Jimmy Page, as seen in the movie *The Song Remains the Same*.[6]

Fig. 6.5-The Theremin[7]

Fig. 6.6-Robert Moog with his Synthesizers[8]

Other pioneers of electronic instruments include Laurens Hammond, who created his electric organ in the 1930's and Robert Moog, the "father" of the modern synthesizer (Fig. 6.6). Moog's synthesizers became the early standard of portable synthesizers when he created his Minimoog. Their sound capabilities were demonstrated early on by Wendy Carlos (formerly Walter Carlos) with her *Switched on Bach* recording, in which

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[5] Albert Glinsky, *Theremin: Ether Music and Espionage* (Chicago, IL: University of Illinois Press, 2000), p. 161.
[6] Tom Hare, "The Theremin." http://www.interfold.com/rabit/Theremin.htm
[7] "Lev Sergeivitch Termen & "The Theremin" (1917)."
<http://www.obsolete.com/120_years/machines/theremin/>
[8] Photo courtesy of MoogArchives.com

she used Moog synthesizers to play all the parts on pieces ranging from selections of the *Well Tempered Clavier* to the *Brandenburg Concerto.* [9]

Ray Kurzweil, an inventor (non-musician) who, among other things, created the first text to speech reader for visually impaired people, which led to an association with Stevie Wonder and the development of his Kurzweil 250 synthesizer (Fig. 6.7). John Chowning of Stanford University is credited with creating FM synthesis (Frequency Modulation), which moved synthesizers from analog to digital technology and was licensed to Yamaha, enabling it to develop and market the incredibly popular DX-7 synthesizer in the 1980's.

Other companies were working on electric pianos/synthesizers that could replace acoustic instruments for artists who were touring. Yamaha developed the CP70/CP80 series pianos, which included real strings and hammers linked to peizo pickups, to create a "portable" piano (Fig. 6.8). While its sound was impressive, the unit broke down into two boxes that still weighed over 100 pounds each.

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[9] Note: Pictures of Wendy Carlos and her studio can be seen at <http://www.wendycarlos.com/photos.html>.

Fig. 6.7-Stevie Wonder and Ray Kurzweil[10]

Fig. 6.8-Yamaha's CP70[11]

Japan's Roland Corporation was also one of the first in that country to begin producing synthesizers and electric pianos. They created an exceptional electric piano in the mid-1980's with their release of the RD1000 Stage Piano. The unit was much more compact than Yamaha's CP70 and did not require tuning after being moved. It did include full size wooden keys that struck pads rather than strings, but had one of the most piano-like feels of anything produced up until that time and was used by some of the major touring rock pianists of the day, including Elton John and Leon Russell. The unit also included a new sound generating system called Structured/Adapted Synthesis or SAS.

> When the SAS system appeared, it was a revelation. With more than 30 keyboard 'zones' differentiated not just by pitch and brightness, but also by individual formant structures and string enharmonicities, it was far superior to any straightforward sample-replay system. For the first time, you could recreate acoustic and electronic pianos on a range of stage instruments, and — most

[10] Jay Leventhal, "The Man and the Machine: An Interview with Ray Kurzweil." *AFB Accessworld,* Vol. 5, #5. <http://www.afb.org/afbpress/pub.asp?DocID=aw050505>

[11] Picture courtesy of Cathedral Stone Music Publishing

> realistically of all — on the range of domestically styled Roland Digital Pianos.[12]

While the RD1000 was an amazing step forward in digital piano technology, it still weighed well over 100 pounds, making it difficult to transport and set up. Roland continued development of their digital pianos, dropping weight and improving sound technology, but never quit created the same feel as wooden keys.

One other famous piano is the venerable Fender Rhodes. Invented in 1949, by Harold Rhodes, this piano took a different tack than anything before or since. Rather than emulating a real piano sound, Rhodes used a type of tuning fork to create sound. Each key, when depressed, would strike a tuning fork housed in the body of the instrument. Though barely audible alone, each fork was also paired with a magnetic pickup that amplified the sound produced, creating distinct timbre, similar to a celesta. It was widely used throughout the 1960's and 1970's by artists ranging from The Door's and Bob Dylan to Chick Corea and Herbie Hancock.[13]

In 1946, in the United States Harry Chamberlin invented an instrument, the precursor to modern sampling technology. Samplers record sounds from the real world and reproduce them electronically, attempting to match the real sound. Mr. Chamberlin created an organ using the best technology available at the time, tape recording. His instrument contained recorded sounds of a mechanical organ for each pitch; one tape for

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[12] Gordon Reid, "The History of Roland: Part 3 1986-1991," *Sound on Sound: The World's Best Music Recording Magazine,* January (2005) http://www.soundonsound.com/sos/jan05/articles/roland.htm.

[13] Julian Colbeck, "Fender Rhodes Stage Piano Mark I: History and Price Guide," *Electronic Muscian.* http://emusician.com/elecinstruments/emusic_fender_rhodes_stage/

every key. When a key was depressed, the tape was activated and the recorded sound could be heard.[14]

The evolution of sampling technology came into its own in the early 1980's, with two companies developing similar systems simultaneously. In 1975, at Dartmouth College, Sydney Alonso and Cameron Jones, with help from Professor John Appleton, developed the prototype of the Synclavier synthesizer/sampler (Fig. 6.9), which was later produced by their company, New England Digital (NED).[15] In Australia, Peter Vogel and Kim Ryrie founded the Fairlight Company and developed the Fairlight CMI (Fig. 6.10). Both systems made extensive use of the latest developments in computer technology to create instruments capable of sampling real world sounds using digital means. Sounds stored on hard drives and laser discs produced results that were far superior compared to the other synthesizers and electric pianos of the same period. However, the price for obtaining this advanced technology could be staggering. With all the system options needed to produce these results, could start at over $20,000 and could exceed $250,000. The price, however, did not stop top recording artists of the 1980's from obtaining these units and making extensive use of them in their music. Stevie Wonder, Herbie Hancock, and Sting all had either Synclaviers or Fairlight CMI's in their studios. [16] Sting's 1988 documentary "Nothing Like the Sun," shows the artist working on a Synclavier, which produced notation simultaneously to creating sounds; not impressive by today's

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[14] -, "A Mellotron History," http://www.mellotron.com/history.htm
[15] -, "The Synclavier," The EMF Institute.
http://emfinstitute.emf.org/exhibits/synclavier.html
[16] Greg Holmes, "The Fairlight CMI," *The Holmes Page.*
http://www.ghservices.com/gregh/fairligh/

standards, but amazing at the time it was produced. By the late 1980's, both companies closed down due to the expense of making these high-end instruments and competition from other companies, like E-Mu Systems and Korg, who produced excellent samplers at much lower prices.

Fig. 6.9-Synclavier Prototype[17]

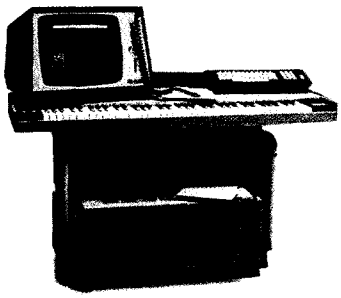

Fig. 6.10-The Fairlight[18]

Many current developers of electronic music technology are creating software that allows computers to create music. Peter Gannon created software, Band-in-a Box (Fig. 6.11), which allows users to enter chords while the program generates accompaniment for the user to play against. Rob Glaser pioneered Internet-based music in creating his company, RealNetworks, which supplies software that allows people to share music and video through the web.

[17] Photo Courtesy of Synclavier European Services
[18] Photo courtesy of Greg Holmes, GH Services

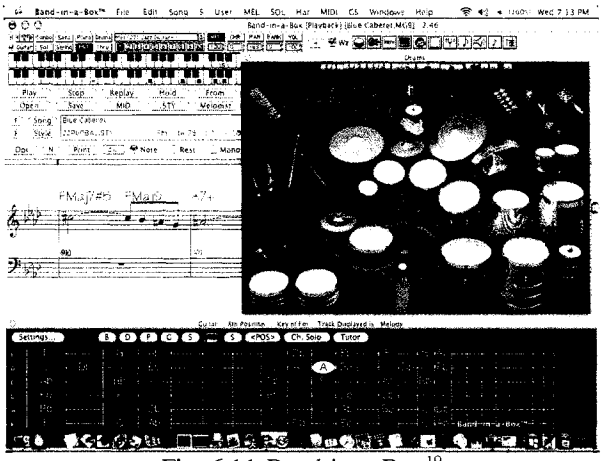

Fig. 6.11-Band-in-a-Box[19]

Computers and synthesizers have also led to innovations in musical instruments that most people would never think possible. Drums seem like an instrument that would never change due to technological advances. Obviously production techniques have changed to use new machinery, but you cannot change the basic principal of a skin stretched across a resonating body. Development of replacements for drums has occurred since the late 1940's. Chamberlin's Rhythmate (Fig. 6.12) and Wurlitzer's Sideman were both examples of drum machines of the 1940's that used tape loops to create drum sounds. During the computer revolution of the 1980's, many companies introduced digital drum machines or rhythm boxes that could produce a variety of drum sounds and were capable of recording a composer's input to create unique drum lines. It was not unusual to find a small "lounge band" of the 80's playing without a drummer, but instead having a beat box pounding out a repeating rhythm in the background.

[19] Band-in-a-Box screen shot courtesy of PG Music, Inc

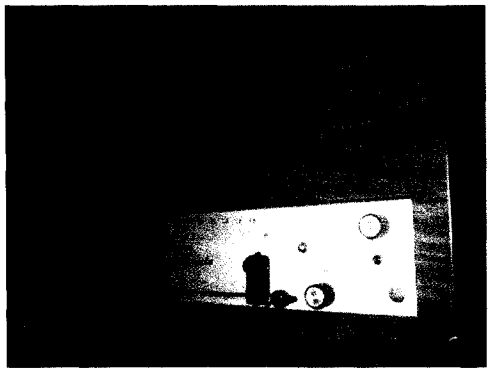

Fig. 6.12-Chamberlin Rhythmate[20]

Instrumentalists looking to replace drums with an electronic alternative had to wait until the 1980's for something that would be a viable replacement for the traditional drum kit. Early examples of electronic drums resembled standard drums, with familiar bodies and stretched heads coupled with electronics, such as the Syndrum (Fig. 6.13) and Simmon's SDS-3. However, the sounds on these units left much to be desired.

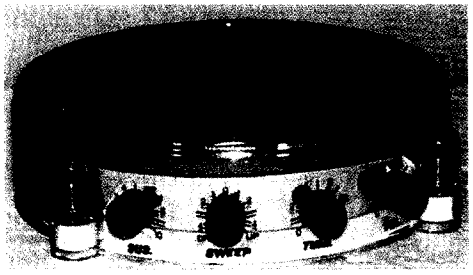

Fig. 6.13-Syndrum[21]

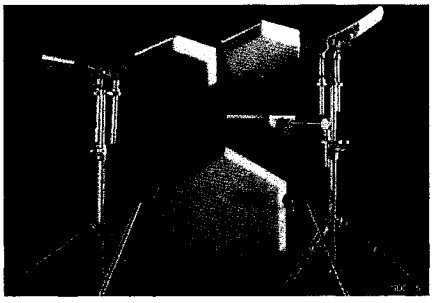

Fig. 6.14-Simmon's SDS-5[22]

Simmon's introduction of later models, including the SDS-5 (Fig. 6.14) met with much greater success and were used extensively by bands of the 1980's. The technology has continued to develop with companies producing more current electronic drums such as Roland's V-Drums (Fig. 15) and Yamaha's DTXplorer (Fig. 6.16).

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[20] Photo courtesy of MatrixSynth
[21] Photo courtesy of Keyboardmuseum.org
[22] Photo courtesy of Synth.net

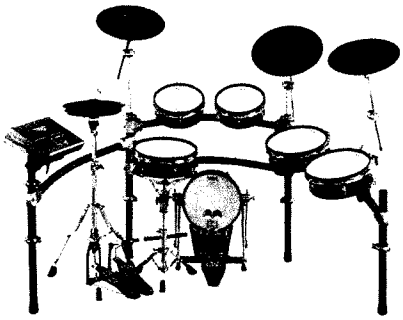

Fig. 6.15-Roland V-Drums [23]

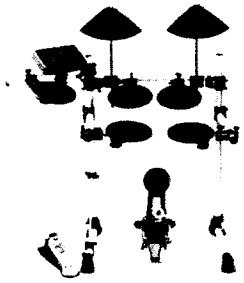

Fig. 6.16-Yamaha DTXplorer[24]

There are those who are still pushing the technology envelope in electronic drums. Moving far away from the idea of the standard drum kit, Roy "Futureman" Wooten decided to see if he could create a drum that played like a guitar. Using a SynthAxe (Fig. 6.17), a guitar like MIDI instrument, as a starting point, Futureman, with engineer Chris deHaas, developed an instrument that is worn like a guitar, but is covered in pressure sensitive MIDI triggers that activate sounds from connected MIDI sound modules. The result is an instrument capable of playing very realistic, sampled drum sounds, as well as any other MIDI sound assigned to the triggers. Dubbed the "Drumitar," (Fig. 6.18) the instrument allows Futureman to use all ten fingers to create drum lines, while leaving his feet free to add other parts with traditional and non-traditional percussion instruments. He has also developed a technique to play the Drumitar with one hand, while holding a drum stick in the other hand to play standard cymbals and drums. Futureman's innovation was adapted for commercial production by David Haney. After seeing Futurman play with Bela Fleck and the Flecktones, Haney

[23] Photo courtesy of Roland Corp.
[24] Photo courtesy of Yamaha Corp.

went on to create the Zendrum (Fig. 6.19). Similar to the Drumitar, the Zendrum is a MIDI-controller based electronic drum.

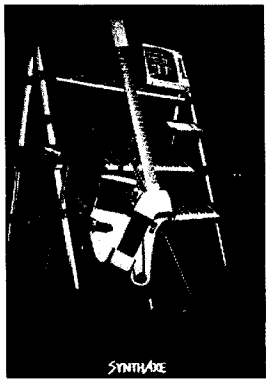

Fig. 6.17-Synthaxe[25]

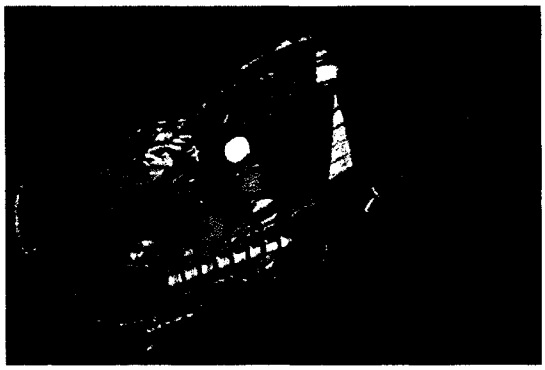
Fig. 6.18-Drumitar[26]

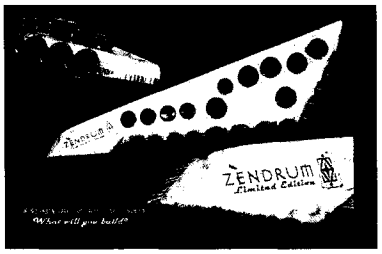

Fig. 6.19-Zendrum[27]

These innovators and others are what make music technology the ever changing, ever evolving area of music that it is today. One possible assignment for a music technology class is to research three individuals/innovators and write a short report on each one. These findings are then shared with the class to help enlighten all the students about the varied people in music technology's history. Many choose to expand their study of these important people for their final project (See Appendix III for an example project).

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[25] Photo courtesy of Phi Software
[26] Photo courtesy of Royel "Futureman" Wooten
[27] Photo courtesy of Zendrum Corp.

Summary and Conclusion

What is the point of the technology that has been discussed? It is to help students become complete, well-rounded individuals within that field of study. Music students tend to believe that their specific area of study is the most important for their future as musicians, rather than the belief that each area of study adds to their knowledge and works towards creating complete musicians.

Music technology covers a broad base of topics that are both useful individually and as a whole. All students in the music program must be able to create legible music from a computer. Long gone are the days when professors would accept hand written work for projects in upper division courses, such as orchestration and counterpoint. This study devotes the largest percentage of time to help students discover how to use notation programs. The key to that use and of understanding computer programs, is found by working with the programs and discovering techniques to work around problems that arise. Students are encouraged to work issues out on their own and in groups, learning to share their discoveries and help others. By teaching someone else how to change time signatures or create repeats in a score, the teacher becomes more adept at doing the task as well.

Computer engineers attempt to set up their programs logically, with an order of operations that makes sense. Before any student is shown how to solve a problem in any computer application, their education is best served by helping them think where the answer to a particular problem should logically exist. This holds true for music notation or sequencing as it does for word processing programs. In Microsoft Word, a student wanting to add a footnote can be shown where the footnote command exists, but will

soon forget that information unless they are doing repetitive footnotes. Even then, the time between writing papers that require a footnote may be long enough to forget where that command exists in the program. If a student is led down a critical thinking path, learning that they are not Formatting a paragraph or changing a View, but rather inserting information, it becomes evident to them that the Footnote command most likely resides in the Insert menu. The same process works for any computer program.

Problems arise in learning about technology when the answers to a particular problem do not follow standard logic. Students then must be shown how to fix or get around a problem, or just learn where a particular answer exists. If a student realizes, for example, that they forgot to add a pickup measure, or anacrusis, to a score, in Finale, the logical place to look for the pickup measure would be the Measure Menu in the Measure tool, but it is not there. A student might think that the anacrusis is at the beginning of the score and is therefore part of the Staff, meaning it should be found in the Staff tool, it is not. The Pickup Measure, in this case, command is in the Options Menu, between Page Format and Playback Options.

When problems are encountered, students must learn how to help themselves. Learning to navigate the internal Help section of a given program is the first step in this process and all help sections are not created equally, so experience with multiple formats is required. Finale, for example, has an enormous and well indexed help resource built into the program. Sibelius, on the other hand, keeps most of its help information in the manual (in the current version of Sibelius, the entire manual is in the help menu) and in it's web based help section. For the web portion, students need to learn how to format

help queries to find the answer to their problem, as their Help Center is question based rather than indexed.

Some incidences are so counter-intuitive that outside assistance is required. Students are encouraged to learn to navigate technical support options when these occurrences arise. Learning to create well-written, logical questions is important, as some companies require all of their tech support questions go through an email process rather than telephone support. They must learn how to deal with tech support representatives in a way that moves them through the process as quickly as possible. The faster a person can demonstrate to the tech support person what he or she knows and has tried in fixing the problem, the faster the help process works.

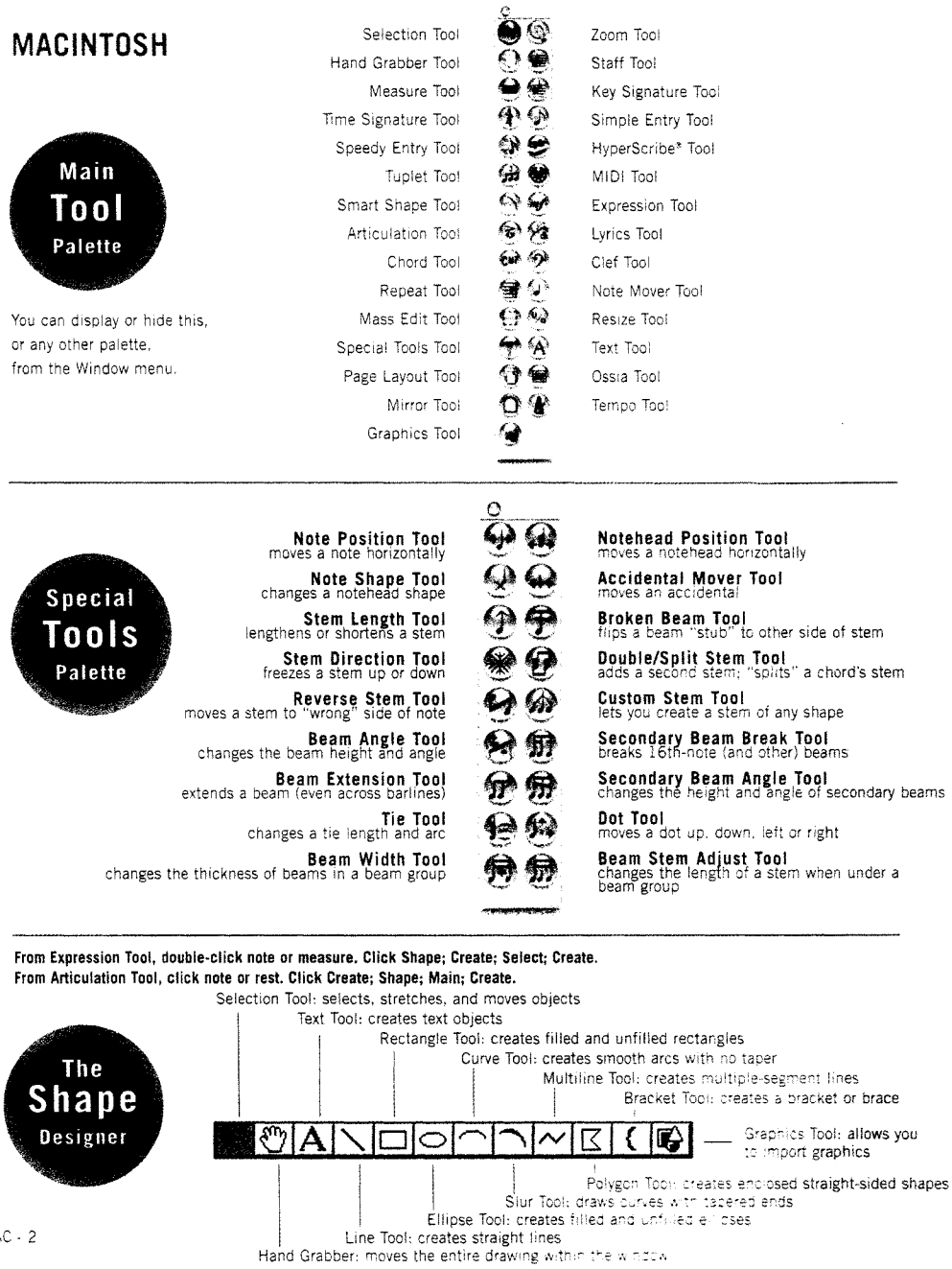
Students must keep a logbook of answers to their own problems. Experienced users do this with any program, in any discipline, and in the music technology course, this log is a required item, to be turned in at the completion of the course. It is important to keep a copy of the Finale shortcut pamphlet (Appendix I) handy at all times and write answers to problems in Finale on that help guide.

This textbook is designed to aid students in their understanding and use of music technology. Used in conjunction with some of the other reference books mentioned, they will have all the tools necessary to develop a wide range of music technology skills. Each skill that the students gain in a program helps them navigate the other programs that they encounter. Experienced computer users can navigate new programs much easier than new users, simply because they have experience with a variety of applications. Every student gains skills in the basic use of computers. For the students that care to apply their new skills to all of their studies, most of what they learn in music technology

is applicable to their entire music education. A student can learn to notate their music into Finale or Sibelius, export it to Digital Performer to create a good sounding accompaniment for their current work, and then record the results on a CD to take to a lesson so their instructor can work with them on the piece. If there is a problem, the student now has the skill to go back and remedy the issue. They have the knowledge and experience to find answers on the internet and know where to look for new programs that can help them in other areas of music, whether it be a program to help create field shows for marching band or a simple program to help teach elementary school children basic music skills. They gain the skills necessary to create attractive and informative, multi-media presentations and are given the opportunity to use those skills in class. Most importantly, students are given the opportunity to learn how to create music using computers and enjoy the process of creation to continue on with a deeper appreciation of technology and how it can work for them in their lives as students, teachers, future teachers, and performers.

Appendix I

Finale Shortcuts[1]



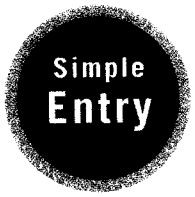
[1] - *Finale 2005: Quick Reference Card* (Eden Prairie, MN: Make Music! Inc., Coda Music Technologies, 2004).

MACINTOSH

Keyboard Shortcuts

	Command	Keyboard Shortcuts or Mouse Clicks
File Menu	Launch Window	Command + Shift + N
	New	Command + N
	Open	Command + O
	Close	Command + W
	Save	Command + S
	Save As	Command + Shift + S
	Print	Command + P
Edit Menu	Undo/Redo	Command + Z/Command + Y
	Undo/Redo Lists	Command + Shift + Z
	Cut	Command + X
	Cut (create Clip file)	Command + Option + X
	Cut (display Items to Clip dialog box)	Command + Shift + X
	Cut (create Clip file and specify items)	Command + Option–Shift + X
	Copy	Command + C
	Copy (create Clip file)	Command + Option + C
	Copy (display Items to Clip dialog box)	Command + Shift + C
	Copy (create Clip file and specify items)	Command + Option–Shift + C
	Insert (insert from a Clip file)	Press Option when choosing "Insert"
	Paste/Replace Entries	Command + V
	Paste/Replace Entries (paste from a Clip file)	Command + Option + V
	Select All	Command + A
	Update Layout	Command + \
	Update Layout and remove measure groupings	Press Shift when choosing "Update Layout"
View Menu	Page View	Option + Command + `
	Scroll View	Option + Command + `
	Home Position	Home key
	End Position	End key
	Redraw Screen	Command + D
	View at 400%	Command + 4
	View At 200%	Command + 2
	View At 100%	Command + 1
	View At 75%	Command + 7
	View At 50%	Command + 5
	View At X %	Command + 0 (zero)
	Zoom In	Command + = also Command + Numpad +
	Zoom Out	Command + - (minus) also Command+Numpad-(minus)
	Fit Width	Command +]
	Fit Page	Command + [
	Layer 1	Option + Command + 1
	Layer 2	Option + Command + 2
	Layer 3	Option + Command + 3
	Layer 4	Option + Command + 4
	Show Multiple Pages	Command + /
General Commands	OK all open dialog boxes	Command + Return, or Command-click the OK button
	Cancel all open dialog boxes	Command + esc, or Command-click the Cancel button
	Show Master Tool Palette dialog box	Command-click anywhere on the screen
	Apply a Metatool	Press a number (0-9) or letter and click the score
	Program a Metatool	Press Shift–number (0-9) of Shift + letter
	Program a keyboard equivalent for a tool	Option + Control + F through Option + Control + ' (apostrophe)—the center row of keys
	Switch to a tool you've programmed	Control + F through Control + ' (apostrophe)
	Select Yes or No in dialog boxes	Type N for "No" and Y for "Yes"
	Switch to Selection Tool	Escape
	Temporarily switch to Hand Grabber Tool	Command + Option (and drag the score)
Playback	Begin/Pause playing (Playback Controls open)	Spacebar
	Begin playing (Playback Controls closed) from the clicked measure	Spacebar + click in staff
	Begin playing from clicked measure in the clicked staff only	Shift + Spacebar + click in staff
	Begin playing from clicked measure in all staves	Spacebar + click in between staves
	Begin playing from measure one in the all staves	Spacebar + click to the left of a staff system
	"Scrub" on screen music - all staves	Option + Spacebar (and drag across music)
	"Scrub" on screen music - current staff only	Option + Shift-Spacebar (and drag across music)
Zoom Tool	Temporary switch to Zoom Tool: enlarge	Command + Shift + click
	Temporary switch to Zoom Tool: reduce	Command + Option + Shift + click
	Fill the screen with the selected area	Drag-enclose an area

MACINTOSH



Keyboard Shortcut Defaults

Accidental	
Double Flat	Shift + -
Double Sharp	Shift + =
Flat	-
Half Step Down	Numpad -
Half Step Up	Numpad +
Natural	N
Parenthesize	P
Sharp	=
Show/Hide (Courtesy)	Cmd + Shift + -

Add Interval	
2nd Above	2
2nd Below	Shift + 2
3rd Above	3
3rd Below	Shift + 3
4th Above	4
4th Below	Shift + 4
5th Above	5
5th Below	Shift + 5
6th Above	6
6th Below	Shift + 6
7th Above	7
7th Below	Shift + 7
8th (Octave) Above	8
8th (Octave) Below	Shift + 8
9th Above	Cmd + Shift + 9
9th Below	Shift + 9
Unison	1

Add Pitch	
At Caret Pitch	Cmd + Enter
At Carat Pitch	Cmd + Return
A	Shift + A
B	Shift + B
C	Shift + C
D	Shift + D
E	Shift + E
F	Shift + F
G	Shift + G

Add/Change Items	
Articulation	Opt + A
Articulation	Numpad *
Articulation – Sticky	Cmd + Opt + Shift + A
Articulation – Sticky	Cmd+Numpad *
Clef	Opt + C
Expression	X
Expression	Opt + X
Key Signature	Opt + K
Time Signature	Opt + T

Change Pitch	
Step Down Diatonically	Opt+Down Arrow
Step Up Diatonically	Opt + Up Arrow
Octave Down Diatonically	Opt + Shift + Down Arrow
Octave Up Diatonically	Opt + Shift + Up Arrow

MACINTOSH

Duration

16th	Opt + 3
16th	Opt + Numpad 3
32nd	Opt + 2
32nd	Opt + Numpad 2
64th	Opt + 1
64th	Opt + Numpad 1
128th	Opt + Shift + `
128th	Opt + 0
128th	Opt + Numpad 0
Augmentation Dot	.
Augmentation Dot	Numpad .
Double Whole	Opt + 8
Double Whole	Opt + Numpad 8
Eighth	Opt + 4
Eighth	Opt + Numpad 4
Half	Opt + 6
Half	Opt + Numpad 6
Quarter	Opt + 5
Quarter	Opt + Numpad 5
Tuplet–Create Default	9
Tuplet–Create Default	Numpad 9
Tuplet–Create User-Defined	Opt + 9
Tuplet–Create User-Defined	Opt + Numpad 9
Whole	Opt + 7
Whole	Opt + Numpad 7

Enter Note

At Caret Pitch	Enter
At Carer Pitch	Return
A	A
B	B
C	C
D	D
E	E
F	F
G	G

Enter Rest

Rest	0
Rest	Numpad 0
Rest	Opt + Enter
Rest	Opt + Return
Rest	Shift + Enter
Rest	Shift + Return
Rest	Tab

Modify

Beam – Break	/
Beam – Flat	Opt + /
Beam – Use Default	Shift + /
Delete	Delete
Delete	Shift + Clear
Enharmonic	\
Grace Note	Opt + G
Show/Hide	H
Stem – Flip	L
Stem – Use Default	Shift + L
Tie – Flip	Cmd + F
Tie to Next Note	Numpad /
Tie to Next Note	T
Tie to Previous Note	Cmd + Numpad /
Tie to Previous Note	Shift + T
Toggle Note/Rest	R

Navigation

Caret/Selection–Clear	Clear
Caret – Step Down	Down Arrow
Caret – Step Up	Up Arrow
Caret – Octave Down	Shift + Down Arrow
Caret – Octave Up	Shift + Up Arrow
Selection – Down	Cmd + Down Arrow
Selection – Up	Cmd + Up Arrow
Selection – One Entry Left	Left Arrow
Selection – One Entry Right	Right Arrow
Selection – One Measure Left	Cmd + Left Arrow
Selection – One Measure Right	Cmd+Right Arrow
Selection – Select All	Cmd + A

Tool

Accidental – Flat	Opt + Minus
Accidental – Natural	Opt + [
Accidental – Sharp	Opt + =
Augmentation Dot	Cmd + Numpad .
Augmentation Dot	Shift + .
Eraser	Opt + Clear
Eraser	Opt + Delete
Grace Note	Cmd + G
Note – 16th	Cmd+Opt+Shift+3
Note – 16th	Numpad 3
Note – 32nd	Cmd+Opt+Shift+2
Note – 32nd	Numpad 2
Note – 64th	Cmd+Opt+Shift+1
Note – 64th	Numpad 1
Note – 128th	Cmd+Opt+Shift+0
Note – Double Whole	Cmd+Opt+Shift+8
Note – Double Whole	Numpad 8
Note – Eighth	Cmd+Opt+Shift+4
Note – Eighth	Numpad 4
Note – Half	Cmd+Opt+Shift+6
Note – Half	Numpad 6
Note – Quarter	Cmd+Opt+Shift+5
Note – Quarter	Numpad 5
Note – Whole	Cmd+Opt+Shift+7
Note – Whole	Numpad 7
Repitch	Shift + R
Repitch	Shift + `
Rest – 16th	Cmd + Numpad 3
Rest – 32nd	Cmd + Numpad 2
Rest – 64th	Cmd + Numpad 1
Rest – 128th	Cmd + Numpad 0
Rest – Double Whole	Cmd + Numpad 8
Rest – Eighth	Cmd + Numpad 4
Rest – Half	Cmd + Numpad 6
Rest – Quarter	Cmd + Numpad 5
Rest – Whole	Cmd + Numpad 7
Tie	Opt + Numpad /
Tie	Cmd + Shift + T
Toggle Note/Rest	Opt + R
Tuplet	Cmd + 9
Tuplet	Cmd + Numpad 9

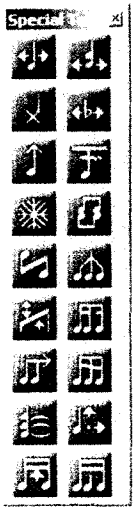
WINDOWS

Main Tool Palette

You can display or hide this, or any other palette, from the Window menu.

Selection Tool	Staff Tool
Key Signature Tool	Time Signature Tool
Clef Tool	Measure Tool
Simple Entry Tool	Speedy Entry Tool
HyperScribe™ Tool	Tuplet Tool
Smart Shape Tool	Articulation Tool
Expression Tool	Repeat Tool
Chord Tool	Lyrics Tool
Text Tool	Mass Edit Tool
Resize Tool	Page Layout Tool

Special Tools Palette



Note Position Tool
moves a note horizontally

Note Shape Tool
changes a notehead shape

Stem Length Tool
lengthens or shortens a stem

Stem Direction Tool
freezes a stem up or down

Reverse Stem Tool
moves a stem to "wrong" side of note

Beam Angle Tool
changes the beam height and angle

Beam Extension Tool
extends a beam (even across barlines)

Tie Tool
changes a tie length and arc

Beam Width Tool
changes the thickness of beams in a beam group

Notehead Position Tool
moves a notehead horizontally

Accidental Mover Tool
moves an accidental

Broken Beam Tool
flips a beam "stub" to other side of stem

Double/Split Stem Tool
adds a second stem; "splits" a chord's stem

Custom Stem Tool
lets you create a stem of any shape

Secondary Beam Break Tool
breaks 16th-note (and other) beams

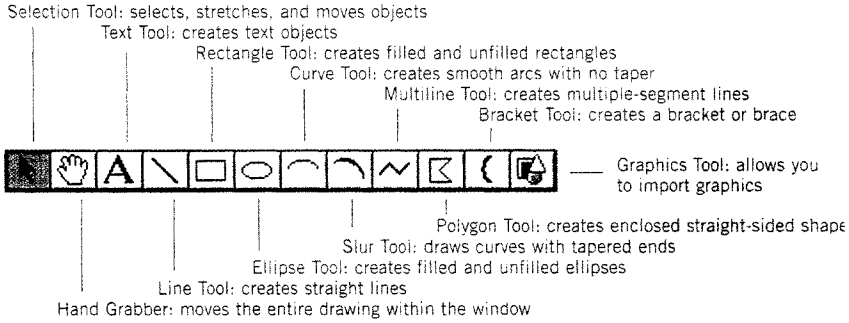
Secondary Beam Angle Tool
changes the height and angle of secondary beams

Dot Tool
moves a dot up, down, left or right

Beam Stem Adjust Tool
changes the length of a stem when under a beam group

From Expression Tool, double-click note or measure. Click Shape; Create; Select; Create.
From Articulation Tool, click note or rest. Click Create; Shape; Main; Create.

The Shape Designer

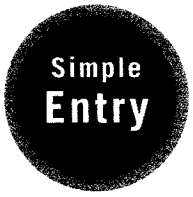


WINDOWS

Keyboard Shortcuts

	Command	Keyboard Shortcuts or Mouse Clicks
File Menu	Launch Window	Control + Shift + N
	New	Control + N
	Open	Control + O
	Close	Control + W
	Save	Control + S
	Print	Control + P
	Exit	Alt + F4
Edit Menu	Undo/Redo	Control + Z/Control + Y
	Undo/Redo Lists	Control + Shift + Z
	Cut	Control + X
	Cut (create Clip file)	Press Control when choosing "Cut"
	Cut (display Items to Clip dialog box)	Press Shift when choosing "Cut"
	Cut (create Clip file and specify items)	Press Control + Shift when choosing "Cut"
	Copy	Control + C
	Copy (create Clip file)	Press Control when choosing "Copy"
	Copy (display Items to Clip dialog box)	Press Shift when choosing "Copy"
	Copy (create Clip file and specify items)	Press Control + Shift when choosing "Copy"
	Insert (insert from a Clip file)	Press Control when choosing "Insert"
	Paste/Replace Entries	Control + V
	Paste/Replace Entries (paste from a Clip file)	Press Control when choosing "Replace Entries"
	Select All	Control + A
	Update Layout	Control + U
	Update Layout and remove measure groupings	Press Shift when choosing "Update Layout"
View Menu	Page View	Control + E
	Scroll View	Control + E
	Home Position	Home key
	End Position	End key
	Redraw Screen	Control + D
	View at 400%	Control + 4
	View At 200%	Control + 2
	View At 100%	Control + 1
	View At 75%	Control + 7
	View At 50%	Control + 5
	View At X %	Control + 0 (zero)
	Zoom In	Control + = also Control + Numpad +
	Zoom Out	Control + - (minus) also Control + Numpad - (minus)
	Fit Width	Control +]
	Fit Page	Control + [
	Layer 1	Alt + Shift + 1
	Layer 2	Alt + Shift + 2
	Layer 3	Alt + Shift + 3
	Layer 4	Alt + Shift + 4
General Commands	OK all open dialog boxes	Control + click the "OK" button
	Cancel all open dialog boxes	Control + click the "Cancel" button
	Redraw Interrupt	Escape
	Apply a Metatool	Press a number or letter and click the score
	Program a Metatool	Press Shift + number or shift + letter
	Program a keyboard equivalent for a tool	Press Shift + Function key (F2-F12)
	Switch to a tool you've programmed	Press Function key (F2-F12)
	Select Yes or No in dialog boxes	Type N for "No" and Y for "Yes"
	Temporarily switch to Hand Grabber Tool	Press the right mouse button, and drag
Playback	Play/Stop	Alt + D + P or Alt + D + O
	Begin playing from the clicked measure	Spacebar + click in staff
	Begin playing from clicked measure in the clicked staff only	Shift + spacebar + click in staff
	Begin playing from clicked measure in all staves	Spacebar + click in between staves
	Begin playing from measure one in all staves	Spacebar + click to the left of a staff system
	"Scrub" onscreen music all staves	Control + spacebar (and drag across music)
	"Scrub" onscreen music - current staff only	Control + Shift + spacebar (and drag across music)
Zoom Tool	Temporary switch to Zoom Tool: enlarge	Shift + click the right mouse button
	Temporary switch to Zoom Tool: reduce	Control + Shift + click the right mouse button
	Fill the screen with the selected area	Drag-enclose an area

WINDOWS



Keyboard Shortcut Defaults

Accidental

Double Flat	Shift + -
Double Sharp	Shift + =
Flat	-
Half Step Down	Numpad -
Half Step Up	Numpad +
Natural	N
Parenthesize	P
Sharp	=
Show/Hide (Courtesy)	Ctrl + Shift + -

Add Interval

2nd Above	2
2nd Below	Shift + 2
3rd Above	3
3rd Below	Shift + 3
4th Above	4
4th Below	Shift + 4
5th Above	5
5th Below	Shift + 5
6th Above	6
6th Below	Shift + 6
7th Above	7
7th Below	Shift + 7
8th (Octave) Above	8
8th (Octave) Below	Shift + 8
9th Above	Ctrl + Shift + 9
9th Below	Shift + 9
Unison	1

Add Pitch

At Caret Pitch	Ctrl + Enter
A	Shift + A
B	Shift + B
C	Shift + C
D	Shift + D
E	Shift + E
F	Shift + F
G	Shift + G

Add/Change Items

Articulation	Alt + A
Articulation	Numpad *
Articulation – Sticky	Ctrl + Alt + Shift + A
Articulation – Sticky	Ctrl + Numpad *
Clef	Alt + C
Expression	X
Expression	Alt + X
Key Signature	Alt + K
Time Signature	Alt + T

Change Pitch

Step Down Diatonically	Alt + Down Arrow
Step Up Diatonically	Alt + Up Arrow
Octave Down Diatonically	Alt + Shift + Down Arrow
Octave Up Diatonically	Alt + Shift + Up Arrow

WINDOWS

Duration

16th	Alt + 3
16th	Alt + Numpad 3
32nd	Alt + 2
32nd	Alt + Numpad 2
64th	Alt + 1
64th	Alt + Numpad 1
128th	Alt + `
128th	Alt + 0
128th	Alt + Numpad 0
Augmentation Dot	.
Augmentation Dot	Numpad Decimal
Double Whole	Alt + 8
Double Whole	Alt + Numpad 8
Eighth	Alt + 4
Eighth	Alt + Numpad 4
Half	Alt + 6
Half	Alt + Numpad 6
Quarter	Alt + 5
Quarter	Alt + Numpad 5
Tuplet – Create Default	9
Tuplet – Create Default	Numpad 9
Tuplet – Create User-Defined	Alt + 9
Tuplet – Create User-Defined	Alt + Numpad 9
Whole	Alt + 7
Whole	Alt + Numpad 7

Enter Note

At Caret Pitch	Enter
A	A
B	B
C	C
D	D
E	E
F	F
G	G

Enter Rest

Rest	0
Rest	Alt + Enter
Rest	Numpad 0
Rest	Shift + Enter
Rest	Tab

Modify

Beam – Break	/
Beam – Flat	Alt + /
Beam – Use Default	Shift + /
Delete	Delete
Delete	Shift + Backspace
Enharmonic	Alt + E
Enharmonic	\
Grace Note	Alt + G
Show/Hide	H
Stem – Flip	L
Stem – Use Default	Shift + L
Tie – Flip	Ctrl + F
Tie to Next Note	Numpad /
Tie to Next Note	T
Tie to Previous Note	Ctrl + Numpad /
Tie to Previous Note	Shift + T
Toggle Note/Rest	R

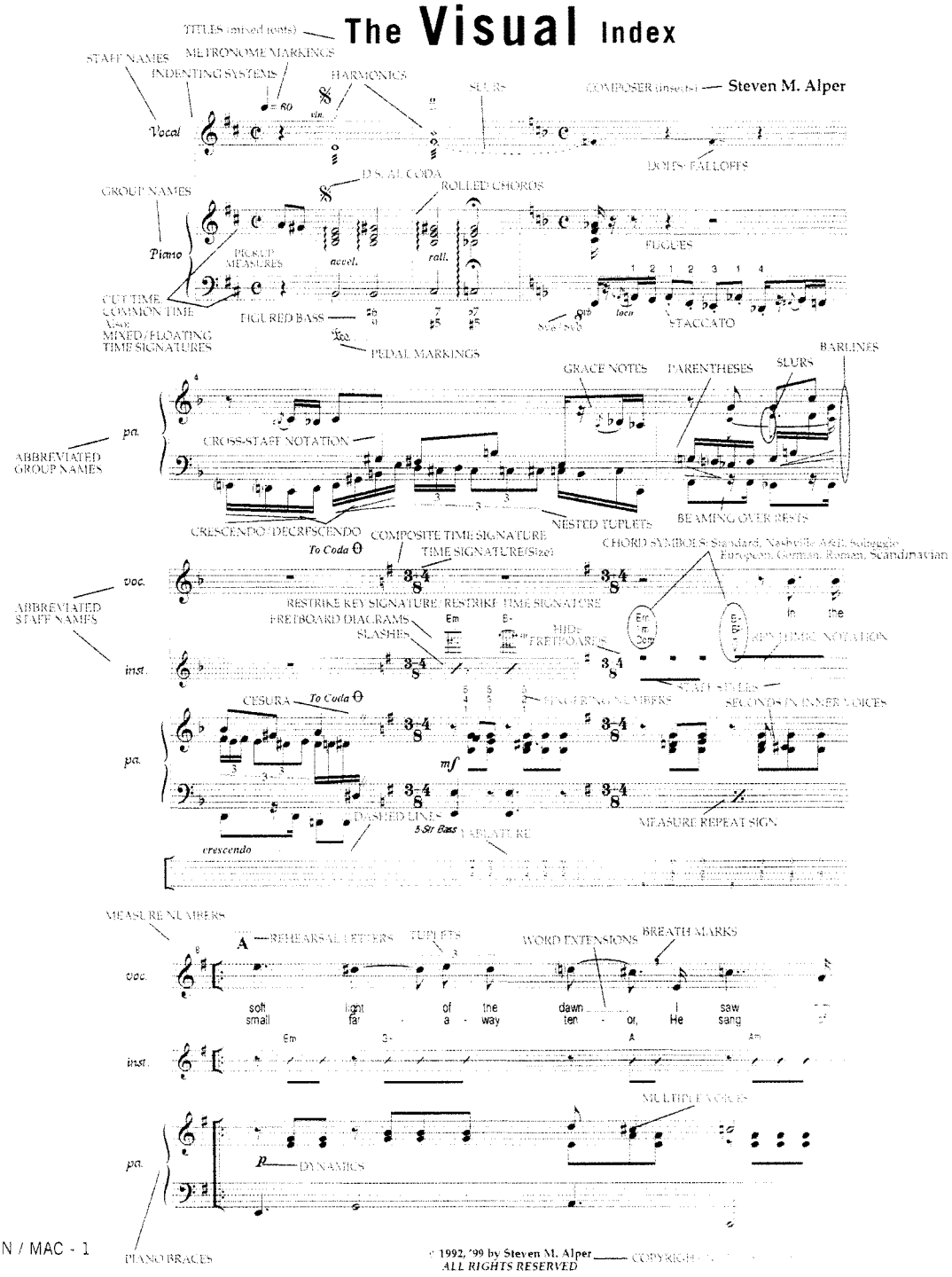
Navigation

Caret/Selection – Clear	Backspace
Caret – Step Down	Down Arrow
Caret – Step Up	Up Arrow
Caret – Octave Down	Shift + Down Arrow
Caret – Octave Up	Shift + Up Arrow
Selection – Down	Ctrl + Down Arrow
Selection – Up	Ctrl + Up Arrow
Selection – One Entry Left	Left Arrow
Selection – One Entry Right	Right Arrow
Selection – One Measure Left	Ctrl + Left Arrow
Selection – One Measure Right	Ctrl + Right Arrow
Selection – Select All	Ctrl + A

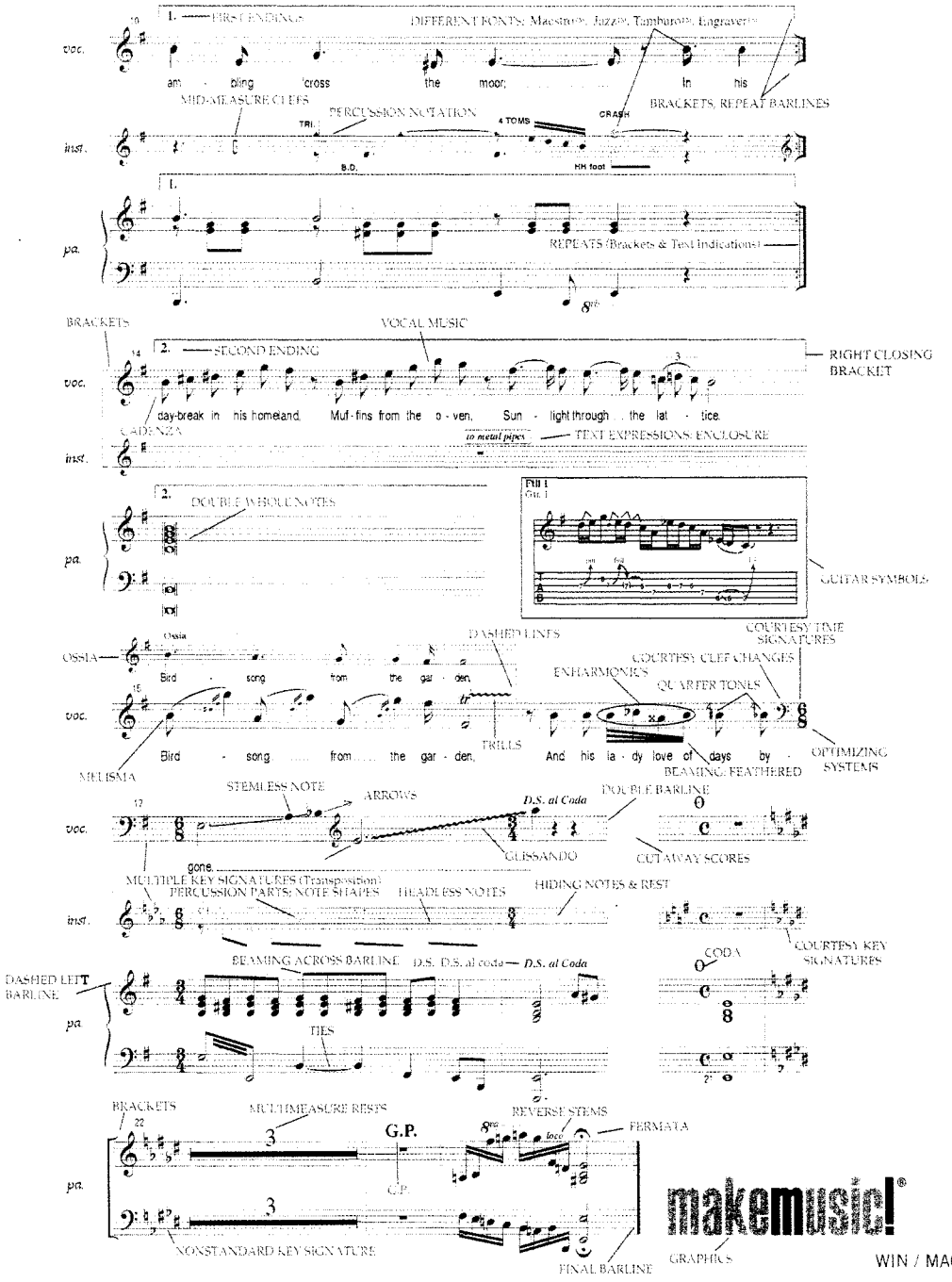
Tool

Accidental – Flat	Alt + Minus Sign
Accidental – Natural	Alt + N
Accidental – Sharp	Alt + =
Augmentation Dot	Ctrl + Numpad .
Augmentation Dot	Shift + .
Eraser	Alt + Backspace
Eraser	Alt + Delete
Grace Note	Ctrl + G
Note – 16th	Ctrl+Alt+Shift+3
Note – 16th	Numpad 3
Note – 32nd	Ctrl+Alt+Shift+2
Note – 32nd	Numpad 2
Note – 64th	Ctrl+Alt+Shift+1
Note – 64th	Numpad 1
Note – 128th	Ctrl+Alt+Shift+0
Note – Double Whole	Ctrl+Alt+Shift+8
Note – Double Whole	Numpad 8
Note – Eighth	Ctrl+Alt+Shift+4
Note – Eighth	Numpad 4
Note – Half	Ctrl+Alt+Shift+6
Note – Half	Numpad 6
Note – Quarter	Ctrl+Alt+Shift+5
Note – Quarter	Numpad 5
Note – Whole	Ctrl+Alt+Shift+7
Note – Whole	Numpad 7
Repitch	Ctrl + R
Repitch	Shift + `
Rest – 16th	Ctrl + Numpad 3
Rest – 32nd	Ctrl + Numpad 2
Rest – 64th	Ctrl + Numpad 1
Rest – 128th	Ctrl + Numpad 0
Rest – Double Whole	Ctrl + Numpad 8
Rest – Eighth	Ctrl + Numpad 4
Rest – Half	Ctrl + Numpad 6
Rest – Quarter	Ctrl + Numpad 5
Rest – Whole	Ctrl + Numpad 7
Tie	Alt + Numpad /
Tie	Ctrl + Shift + T
Toggle Note/Rest	Alt + R
Tuplet	Ctrl + 9
Tuplet	Ctrl + Numpad 9

WINDOWS AND MAC



WINDOWS AND MAC



Appendix II

Sibelius Shortcuts[1]

Description/menu item	*Mac shortcut*	*Windows shortcut*
Help		
Sibelius Help	⌘?	F1
Files		
New	⌘N	Ctrl+N
Open	⌘O	Ctrl+O
Close	⌘W	Ctrl+W
Save	⌘S	Ctrl+S
Print	⌘P	Ctrl+P
Extract Parts	⇧⌘X	Ctrl+Shift+X
Quit/Exit	⌘Q	Alt+F4
Creating notes		
𝅘𝅥𝅯 / 𝅘𝅥𝅰 / 𝅘𝅥𝅱 / 𝅘𝅥 / 𝅗𝅥 / 𝅝	1/2/3/4/5/6 (on keypad) or ⌥Z/X/C/A/S/D	1/2/3/4/5/6 (on keypad) or Ctrl+Alt+Z/X/C/A/S/D
♮ / ♯ / ♭ (on/off)	7/8/9 (on keypad) or ⌥Q/W/E	7/8/9 (on keypad) or Ctrl+Alt+Q/W/E
>. – (on/off)	= / *	/ * -
Rhythm dot	. (period)	. (period)
Create note	A/B/C/D/E/F/G or play note/chord on MIDI keyboard	A/B/C/D/E/F/G or play note/chord on MIDI keyboard
Create rest	space	space
Add Interval above	1/2/3/4/5/6/7/8/9 (on main keyboard)	1/2/3/4/5/6/7/8/9 (on main keyboard)
Add Interval below	⇧-1/2/3/4/5/6/7/8/9 (on main keyboard)	Shift+1/2/3/4/5/6/7/8/9 (on main keyboard)
Add Pitch above	⇧-A–G	Shift+A–G
Tie (on/off)	Enter (on keypad)	Enter (on keypad)
Start a new voice	V ⌥1/2/3/4	V Alt+1/2/3/4
Flexi-time™		
Flexi-time	⇧⌘F	Ctrl+Shift+F
Stop Flexi-time	Esc / ⌘.	Esc
Flexi-time Options	⇧⌘O	Ctrl+Shift+O
Editing notes		
Edit pitch	A/B/C/D/E/F/G or play note/chord on MIDI keyboarc	A/B/C/D/E/F/G or play note/chord on MIDI keyboard

[1] Ben Finn, Daniel Spreadbury, and Jonathan Finn, *Sibelius 2* [Manual] (Cambridge, UK: Sibelius Software, 2001), pp. 246-253.

Description/menu item	*Mac shortcut*	*Windows shortcut*
Edit note value: 𝅘𝅥𝅯 / 𝅘𝅥𝅮 / 𝅘𝅥 / 𝅗𝅥 / 𝅗𝅥 / 𝅝	**1/2/3/4/5/6** (on keypad) or **⌥Z/X/C/A/S/D**	**1/2/3/4/5/6** (on keypad) or **Ctrl+Alt+Z/X/C/A/S/D**
Edit accidental: ♮ / ♯ / ♭ (on/off)	**7/8/9** (on keypad) or **⌥Q/W/E**	**7/8/9** (on keypad) or **Ctrl+Alt+Q/W/E**
Edit articulation(s): > . – (on/off)	**= / ***	**/ * -**
Turn into rest(s)	**Delete** or **Backspace**	**Delete** or **Backspace**
Turn into individual rest(s)	**0** on first keypad layout	**0** on first keypad layout
Respell Accidental	**Return** (on main keyboard)	**Return** (on main keyboard)
Cross-staff notes ▸ Move up/down a staff	**⇧⌘↑/↓**	**Ctrl+Shift+↑/↓**
Standard notehead	**⇧⌥0** (on main keyboard)	**Shift+Alt+0** (on main keyboard)
Change notehead	**⇧⌥ 0/1/2/3**... (or two digits)	**Shift+Alt+0/1/2/3**... (or two digits)
Swap voices 1 and 2	**⇧V**	**Shift+V**
Transpose	**⇧T**	**Shift+T**
Arrange	**⇧⌘V**	**Ctrl+Shift+V**
Creating objects		
Create menu	**Control**-click (with nothing selected)	**Shift+F10** / right-click (with nothing selected)
Bar at end	**⌘B**	**Ctrl+B**
Single bar (in mid-score)	**⇧⌘B**	**Ctrl+Shift+B**
Other bar (multiple/irregular)	**⌥B**	**Alt+B**
Clef	**Q**	**Q**
Guitar frame	**U**	**U**
Instruments	**I**	**I**
Key signature	**K**	**K**
Line	**L**	**L**
Slur/flipped slur	**S**/**⇧S** (then **space** to extend)	**S**/**Shift+S** (then **space** to extend)
Crescendo/diminuendo hairpin	**H**/**⇧H** (then **space** to extend)	**H**/**Shift+H** (then **space** to extend)
Rehearsal mark	**⌘R**	**Ctrl+R**
Symbol	**Z**	**Z**
Time signature	**T**	**T**
Triplet	**⌘3** (on main keyboard)	**Ctrl+3** (on main keyboard)
Tuplet	**⌘2-9**	**Ctrl+2-9**

Description/menu item	*Mac shortcut*	*Windows shortcut*
Creating text		
Chord symbol	⌘K	Ctrl+K
Expression	⌘E	Ctrl+E
Lyrics	⌘L	Ctrl+L
Lyrics verse 2	⌥⌘L	Ctrl+Alt+L
Metronome mark	⌥⌘M	Ctrl+Alt+M
Technique	⌘T	Ctrl+T
Tempo	⌥⌘T	Ctrl+Alt+T
Editing text		
Start editing	**Return** (on main keyboard) / double-click	**Return** (on main keyboard) / **F2** / double-click
Stop editing	**Esc** ⌘.	**Esc**
Move left/right a character	←/→	←/→
Move left/right a word	*none*	Ctrl+←/→
Move to start/end of line	*none*	**Home/End**
Move to start/end of text	*none*	Ctrl+Home/End
Select word	double-click	double-click
Select next/previous character	⇧←/→	Shift+←/→
Select to end/beginning of word	*none*	Ctrl+Shift+←/→
Select to end/beginning of text	*none*	Ctrl+Shift+Home/End
Select All text	⌘A	Ctrl+A
Delete previous/next character	**Backspace**	**Backspace/Delete**
Delete previous/next word	*none*	Ctrl+Backspace/Delete
Replace selected text	type new text	type new text
New line	**Return / Enter**	**Return / Enter**
Bold/italic/underline on/off	⌘B/I/U	Ctrl+B/I/U
Advance to next note/beat (lyrics/chord symbols/figured bass/fingering)	**space**	**space**
Hyphens to next note (lyrics)	**-** (hyphen)	**-** (hyphen)
Elision (lyrics)	_ (underscore)	_ (underscore)
Non-breaking space/hyphen (lyrics/chord symbols)	⌘-space/hyphen	Ctrl+space/hyphen
Word menu	Control-click	Shift+F10 / right-click
f / ***m*** / ***p*** / ***r*** / ***s*** / ***z*** (Expression)	⌘F/M/P/R/S, ⇧⌘Z	Ctrl+F/M/P/R/S, Ctrl+Shift+Z

Description/menu item	*Mac shortcut*	*Windows shortcut*
cresc. / dim. (Expression)	⇧⌘C/D	Ctrl+Shift+C/D
𝅘𝅥𝅯 / 𝅘𝅥𝅰 / 𝅘𝅥𝅱 / 𝅘𝅥 / 𝅗𝅥 / 𝅝 / ♮ / ♯ / ♭	⌘1/2/3... (on keypad)	Ctrl+1/2/3... (on keypad)
à / è / ì / ò / ù	⌥` followed by letter (e.g. ⌥` A)	Ctrl+Shift+Alt+A/E/I/O/U
á / é / í / ó / ú	⌥' followed by letter	Ctrl+Shift+A/E/I/O/U
ä / ë / ï / ö / ü	⌥U followed by letter	Alt+number from Character Map
â / ê / î / ô / û	⌥I followed by letter	Alt+number from Character Map
ç / Ç	⌥C / ⇧⌥C	Alt+number from Character Map
Other special characters	use **Key Caps** utility	Alt+number from Character Map
" / " (smart quotes)	⌥2 / ⇧⌥2	Alt+2 / Shift+Alt+2
' / ' (smart single quotes)	⌥' / ⇧⌥'	Alt+' / Shift+Alt+'
©	⇧⌘C	Ctrl+Shift+C
~~𝄋~~ (in Lyricist/Title/Copyright text)	⇧⌘P	Ctrl+Shift+P
𝄋 (in Tempo text)	⇧⌘4	Ctrl+Shift+4
𝄐 (in Tempo text)	⌘0 (zero)	Ctrl+0 (zero)
← / → (in metric modulations)	⌘[/]	Ctrl+[/]
Harp pedal diagrams (Technique text)	⌥⌘7/8/9/+ (on keypad)	Ctrl+Alt+7/8/9/+ (on keypad)
% (chord symbols)	⇧5	Shift+5
° / ø / Δ (chord symbols)	⌘O / ⇧⌘O / ⇧6	Ctrl+O / Ctrl+Shift+O / Shift+6
add / omit (chord symbols)	⇧⌘A / ⌥⌘O	Ctrl+Shift+A / Ctrl+Alt+O
( ) (for stackable alterations in chord symbols)	[ ]	[ ]
Guitar tab		
Create notes	see **Creating notes** above	see **Creating notes** above
Change fret	⇧⌥ 0/1/2/3... (or two digits)	Shift+Alt+0/1/2/3... (or two digits)
Move up/down a string	↑/↓	↑/↓
Move to top/bottom string	⌘↑/↓	Ctrl+↑/↓
Bend	J (then **space** to extend)	J (then **space** to extend)
Pre-bend / slide / bracket notehead	. / * / 1 on second keypad layout	. / - / 1 on second keypad layout
Quarter-tone sharp	= (on main keyboard)	= (on main keyboard)

Description/menu item	*Mac shortcut*	*Windows shortcut*
Playback		
Play or Pause	P	P
Rewind/fast-forward	←/→	←/→
Stop	Esc / ⌘.	Esc
All Notes Off	⇧O	Shift+O
Mixer (show/hide)	M	M
Performance	⇧P	Shift+P
Editing objects		
Undo	⌘Z	Ctrl+Z
Redo	⌘Y	Ctrl+Y
Undo History	⇧⌘Z	Ctrl+Shift+Z
Redo History	⇧⌘Y	Ctrl+Shift+Y
Cut	⌘X	Ctrl+X
Copy	⌘C	Ctrl+C
Copy to where you click	⌥-click	Alt+click
Paste	⌘V	Ctrl+V
Repeat (note/chord/passage/text/line/etc.)	R	R
Delete/Clear	Backspace (←)	Backspace or Delete
Flip (stem, slur, tuplet, tie, etc.)	X	X
Put into voice 1/2/3/4/all voices	⌥1/2/3/4/5 (on main keyboard)	Alt+1/2/3/4/5 (on main keyboard)
Hide	⇧⌘H	Ctrl+Shift+H
Show	⇧⌘S	Ctrl+Shift+S
Navigation		
Select first object on page (if nothing selected)	Tab	Tab
Select next/previous object	Tab/⇧-Tab	Tab/Shift+Tab
Select previous/next note/chord/rest	←/→	←/→
Select start of previous/next bar	⌘←/→	Ctrl+←/→
Select end/mid-point/whole of line	⌥←/→	Alt+←/→
Select note/rest above/below (in chord or adjacent staff)	⌥↑/↓	Alt+↑/↓
Move score	drag navigator/paper	drag navigator/paper
Go up/down a screenful	⇞/⇟ or Page Up/Down	Page Up/Down
Go left/right a screenful	↖/↘ (⇧↖) or Home/End	Home/End

Description/menu item	*Mac shortcut*	*Windows shortcut*
Go to top/bottom of page	⌘⇞/⇟ or ⌘-Page Up/Down	Ctrl+Page Up/Down
Go to first/last page	⌘↖/↘ (⇧↖) or ⌘-Home/End	Ctrl+Home/End
Go to Bar	⌥⇧G	Ctrl+Alt+G
Go to Page	⇧⌘G	Ctrl+Shift+G
Zoom in/out	⌘=/– (or click/⌥-click with zoom tool; ⇧ holds tool)	Ctrl+=/- (or click/right-click with zoom tool; **Shift** holds tool)
Moving objects		
Move object(s) (in larger steps; 1 space by default)	↑/↓/←/→ (⌘↑/↓/←/→)	↑/↓/←/→ (Ctrl+↑/↓/←/→)
Move staff/staves up/down (in larger steps; 1 space by default)	⌥↑/↓ (⌘⌥↑/↓) or drag	Alt+↑/↓ (Ctrl+Alt+↑/↓) or drag
Move staff/staves up/down independently (in larger steps; 1 space by default)	⇧⌥↑/↓ (⌘⇧⌥↑/↓) or ⇧-drag	Shift+Alt+↑/↓ (Ctrl+Shift+Alt+↑/↓) or Shift+drag
Move note/rest/end of tie (in larger steps; 1 space by default)	⇧⌥←/→ (⇧⌥⌘←/→)	Shift+Alt+←/→ (Ctrl+Shift+Alt+←/→)
Move line (either end) or lyric/previous note	space/⇧-space	space/Shift+space
Multiple selections & passages		
Select bar	click staff (avoiding notes etc.)	click staff (avoiding notes etc.)
Select bar in all staves	⌘-click staff	Ctrl+click staff
Select all bars in staff (on one system)	double-click staff	double-click staff
Select all bars in all staves (on one system)	⌘-double-click staff	Ctrl+double-click staff
Select all bars in staff throughout score	triple-click staff	triple-click staff
Select System Passage	⇧⌥A	Shift+Alt+A
Extend passage to object	⇧-click	Shift+click
Extend passage by a note/rest	⇧←/→	Shift+←/→
Extend passage by a bar	⇧⌘←/→	Ctrl+Shift+←/→
Extend passage by a staff	⇧↑/↓	Shift+↑/↓
Select All of score	⌘A	Ctrl+A
Select all noteheads in chord (**Select More**)	⇧⌘A or double-click	Ctrl+Shift+A or double-click
Select all text on staff in same style (**Select More**)	⇧⌘A	Ctrl+Shift+A
Select objects with marquee	⌘-drag on paper	Ctrl+drag on paper
Add/remove object to/from selection	⌘-click	Ctrl+click
Select None	Esc / ⌘.	Esc

Description/menu item	*Mac shortcut*	*Windows shortcut*
Filters and Find		
Advanced Filter	⌥⌘F	Ctrl+Alt+F
Filter Dynamics	⌥⇧D	Shift+Alt+D
Filter Voice 1/2/3/4	⌥⇧⌘1/2/3/4	Ctrl+Shift+Alt+1/2/3/4
Filter Top/2nd/3rd/Bottom Note or Single Notes	⌥⌘1/2/3/B	Ctrl+Alt+1/2/3/B
Find	⌘F	Ctrl+F
Find Next	⌘G	Ctrl+G
View options		
Notes out of Range	⌥⌘N	Ctrl+Alt+N
Pitch Spectrum	⌥⌘P	Ctrl+Alt+P
Hidden Objects (show/hide)	⌥⌘H	Ctrl+Alt+H
Object Rulers (show/hide)	⇧⌥R	Shift+Alt+R
Staff Rulers (show/hide)	⇧⌥⌘R	Ctrl+Shift+Alt+R
Transposing Score	⇧⌘T	Ctrl+Shift+T
Properties (show/hide)	⌘I	Ctrl+I
Full Screen (Windows only)	*none*	Ctrl+U
Layout		
Document Setup	⌘D	Ctrl+D
System Break on/off	Return (on main keyboard)	Return (on main keyboard)
Page Break on/off	⌘-Return (on main keyboard)	Ctrl+Return (on main keyboard)
Lock Format	⇧⌘L	Ctrl+Shift+L
Unlock Format	⇧⌘U	Ctrl+Shift+U
Make Into System	⌥⇧M	Shift+Alt+M
Make Into Page	⌥⇧⌘M	Ctrl+Shift+Alt+M
Align in a Row/Column	⇧⌘R/C	Ctrl+Shift+R/C
Hide Empty Staves	⇧⌥⌘H	Ctrl+Shift+Alt+H
Show Empty Staves	⇧⌥⌘S	Ctrl+Shift+Alt+S
Reset Position	⇧⌘P	Ctrl+Shift+P
Reset Design	⇧⌘D	Ctrl+Shift+D
Reset Note Spacing	⇧⌘N	Ctrl+Shift+N
Condense/expand note spacing (in larger steps; 1 space by default)	⇧⌥←/→ (⇧⌥⌘←/→)	Shift+Alt+←/→ (Ctrl+Shift+Alt+←/→)

Description/menu item	*Mac shortcut*	*Windows shortcut*
House Style™		
Engraving Rules	⇧⌘E	Ctrl+Shift+E
Edit Text Styles	⇧⌥⌘T	Ctrl+Shift+Alt+T
Use Multirests on/off	⇧⌘M	Ctrl+Shift+M
Menus and dialogs		
Go into menu	*none*	Alt+underlined letter
Choose from menu	*none*	underlined letter
Choose from dialog	*none*	Alt+underlined letter
Move to next/previous box in dialog	Tab/⇧-Tab	Tab/Shift-Tab
Select consecutive items from list	drag	Shift+click or drag
Select separate items from list	⌘-click	Ctrl+click
OK (or default button)	Return/Enter	Return/Enter
Cancel	Esc / ⌘.	Esc
Keypad layouts	F8–F12	F8–F12
Next keypad layout	+ (on keypad)	+ (on keypad)
Back to first keypad layout	– (on keypad) / F8	F8 (Shift++ on Windows 2000/XP)
Contextual edit menu	**Control**-click on selected object(s)	**Shift+F10** / right-click on selected object(s)
Change window	⌘~	Ctrl+Tab
Hide window	⌘H (Mac OS X only)	*none*
Minimize window	⌘M (Mac OS X only)	*none*

Appendix III

Ben Deovlet's Paper

The Ghost of Brahms,
Courtesy of Cigar Bill Neiman

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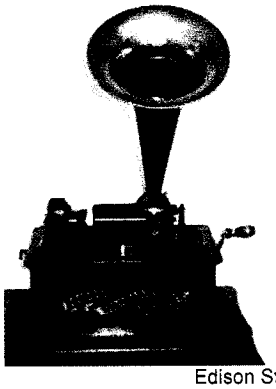

Edison Standard Phonograph

The Ghost of Brahms,

Courtesy of Cigar Bill Neiman

A project in reconstruction of Edison cylinder recordings and the development of technological techniques for the restoration of the sound by Dr. Jonathan Berger, CCRMA, Music Department, Stanford University.

Report presented by Ben Deovlet

San Jose State University, Music 13, December 6, 2005

Introduction

Today, we take recorded sound for granted. The technology has evolved to the level that a single i-Pod can hold more recordings than were done during the entire first half of the twentieth century. We now have the ability to send digital representations almost instantaneously over vast distances without degrading the fidelity. The earliest commercially viable recording medium was wax. The wax was formed into small cylinders that were spun on a small lathe to record and to reproduce the sound. A small needle was used to engrave the wax for recording. A similar needle was used to reproduce the recording. There were no electronics involved: thin metal diaphrams were coupled to the needles to serve as the air-to-wax interface. Acoustical horns were used both in recording and in playback to amplify the sound.

Needless to say, these early wax cylinder recordings and their apparatus were fragile and offered limited recording time and fidelity. In addition, the wax medium degraded easily with each repeated playback. Now, over a century later, efforts are underway to reconstruct the recorded sounds of history. Several institutions are involved in this endevour. One such institution is the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University. Under the direction of Dr. Jonathan Berger, Johannes Brahms' 1889 recording of the first Hungarian Dance was accurately restored. This is one of the earliest known recordings and perhaps the only actual historical glimpse of Brahm's actual playing. Sophisticated algorithms were developed in order to extract and to reconstruct the desired sounds from the noise and artifacts. Successfully straddling technology and art, the completed refurbished performance is playable on an acoustic reproducing piano such as Yamaha's Disklavier. In effect, it recreates Brahms himself playing Brahms. Watching the Disklavier's keys and pedals move with the music, it gives one the strong impression that it is indeed Brahms, or perhaps his ghost, doing the playing.

Historical Perspective of the Phonograph

Thomas Edison's favorite invention was the phonograph. In 1877, he created a way to record sound on tinfoil cylinders by using two needles, one for recording and one for playback. The first words that Edison recorded were "Mary Had a Little Lamb." Ten years later, in 1887, Edison formed the Edison Phonograph Company to sell the phonograph to the public. This marked the beginning of the sound recording industry. The first records sold by the Edison and Columbia Phonograph Companies were on wax cylinders. These were brittle and broke easily. Columbia ceased production of wax cylinders in 1909 when discs became popular. The Edison National Phonograph Company continued making cylinders and discs until 1929. Cylinder records and other recordings made throughout the twentieth century are valuable primary resources. For the first time in political history, candidates in the 1908 presidential election (William Howard Taft, Republican and William Jennings Bryan, Democrat) recorded speeches that were sold to the public.

Edison's method of recording, patented in 1878, allowed for recordings up to three minutes duration. In the closing years of the nineteenth century a number of competitive recording technologies were developed (including Tainter's lateral-cut records, Tainter and Bell's Graphophone, and Berliner's Gramophone).

Among the earliest examples of recorded music is that of Brahms' 1889 recording of the first Hungarian Dance.

The early cylinders had two significant problems. The first was the short length of the cylinders, only 2 minutes. This necessarily narrowed the field of what could be recorded. The second problem was that no mass method of duplicating cylinders existed. Most often, performers had to repeat their performances when recording in order to amass a quantity of cylinders. This was not only time-consuming, but costly.

A process for mass-producing duplicate wax cylinders was put into effect in 1901. The cylinders were molded, rather than engraved by a stylus, and a harder wax was used. The process was referred to as Gold Moulded, because of a gold vapor given off by gold electrodes used in the process. Sub-masters were created from the gold master, and the cylinders were made from these molds. From a single mold, 120 to 150 cylinders could be produced every day. By 1900 recordings could be reproduced using Lambert's patent for moulding durable celluloid and the stage was set for a viable industry of commercial recordings. The recordings in this collection represent the first generations of the music industry. The recordings are all done without microphones (which have yet to be invented). Many lasting features of the recording industry ranging from the distinction between ownership of medium and media, the length of popular music songs (a constraint of the cylinder), exclusive artist contracts, and more, were institutionalized during this period.

Photo of Edison with cylinder phonograph in 1878

CCRMA

The Stanford University Center for Computer Research in Music and Acoustics (CCRMA) is a multi-disciplinary facility where composers and researchers work together using computer-based technology both as an artistic medium and as a research tool.

Areas of ongoing interest at CCRMA include: composition, synthesis techniques and algorithms, physical modeling, signal processing, digital recording and editing, psychoacoustics and musical acoustics, real-time applications and controllers, collaborative works with other art disciplines, and music manuscripting by computer.

The CCRMA community consists of administrative and technical staff, faculty, research associates, graduate research assistants, graduate and undergraduate students, visiting composers, musicians and scholars, and industrial associates. Center activities include academic courses, seminars, small interest group meetings, summer workshops and colloquia. Concerts of computer music are presented several times each year with an annual outdoor computer music festival in July. In-house technical reports and recordings are available, and public demonstrations of ongoing work at CCRMA are held periodically.

CCRMA recently received a donation of an extensive collection of pre-1920 audio recordings and equipment. The collection provides an astonishing audio portrait of the United States one hundred years ago. The goal of this project is to make these materials widely available for educational purposes. The collection is housed at CCRMA.

The collection includes over 1500 pre-1920 cylinder recordings, cylinder players and supporting peripheral equipment and materials. The recordings include classical, popular, folk, and spiritual and march music, Vaudeville routines and speeches.

The actual collection can be used as teaching and research materials for classes and individual research at Stanford. The materials are currently being cataloged, researched and transferred by graduate and undergraduate research associates with the goal of making the collection available to all. The cylinders and players are available by arrangement for student, faculty and community use. As the cataloging and research efforts are primarily student projects this on-line museum of historical recordings will be continually developing.

Projects using these materials include:

- historical studies of popular American culture,
- historical research on the music and recording industries,
- the evolution of popular music,
- the history of popular dance
- Engineering and scientific research on techniques of audio restoration, preservation and archiving.

The Project and the Challenge

In Late 2001, Stanford University associate professor of music Dr. Jonathan Berger received an unexpected package in the mail. The plain brown wrapper gave no hint of the contents. There was no return address. Due to the fears immediately following the 9/11/2001 attacks, the package remained unopened for quite a bit of time. However, curiosity triumphed over caution—Berger opened the package to find a cassette tape. Baffled, he popped it into his car's deck.

A frail, elderly voice identified itself as "Cigar Bill" Neiman, a retired worker in the Submarine yards at New England. After apologizing that he was no longer able to write, Neiman said his lifelong hobby was collecting Thomas Edison cylinder recordings. He feared his treasures would be liquidated in a garage sale after his death. Because he had heard Berger talk about restoring an old cylinder recording of Johannes Brahms, Neiman wanted to bequeath the entire collection to him. Berger suggested contacting the Smithsonian Institution or another library to house such a valuable and fragile archive, but Cigar Bill was adamant: he did not want his collection to sit gathering dust. He wanted people to hear it and students to use it for research.

Berger acquiesced, and Stanford's Center for Computer Research in Music and Acoustics (CCRMA, pronounced karma) gained 1,500 pre-1920 cylinder recordings including classical, popular, folk, and spiritual and march music; vaudeville routines; speeches; two Edison phonographs; and peripheral equipment. Cigar Bill died shortly after his gift was safely stowed at the Knoll, home to the newly renovated CCRMA offices and studios.

One recording was of keen interest to Dr. Berger. On December 2nd 1889, Theo Wangemann, a representative of Thomas Edison recorded Johannes Brahms performing two segments of music at the piano. The works recorded included part of a paraphrase of Strauss' Libelle, preceded by measures 13-72 of Brahms' 1872 arrangement of the first

Hungarian Dance for solo piano. Dr. Berger has a passion for the music of Johannes Brahms.

At first listening, this Edison cylinder recording was described it as so noisy that most listeners could not tell that a piano was playing. Various attempts to filter and enhance the recording had yielded nothing of musicological significance. Berger's challenge was to separate out the noise, and then digitally represent the music, staying true to the original. He likened the process to a paleontologist painstakingly removing layer upon layer of dirt with a toothbrush to reach the dinosaur bones hidden underneath.

Brahms at the Piano

On December 2nd 1889, Theo Wangemann, a representative of Thomas Edison recorded Johannes Brahms performing two segments of music at the piano. The works recorded included part of a paraphrase of Strauss' Libelle, preceded by measures 13-72 of Brahms' 1872 arrangement of the first Hungarian Dance for solo piano. While this unique historical document should have been hailed as an important 'window' to the world of nineteenth century music performance practices, the musical information was almost entirely masked by noise. The recording was, in fact, so noisy that musicologist Gregor Benko wrote that, "Any musical value heard [in the cylinder recording] can be charitably described as the product of a pathological imagination."

Indeed, despite various attempts at filtering and enhancing the recording, the poor quality of the cylinder recording resulted in a general consensus that the recording was of no significant musicological value. Using an innovative approach to audio signal analysis, Dr. Jonathan Berger and his graduate students were able to transcribe the music by painstakingly removing layers of noise to reveal the music embedded within. Transcription was followed by careful analysis of the numerous performance nuances, agogic inflections, improvised segments and added elaborations.

Technical Information

Goals

The Edison Project focused on achieving two primary goals: (1) Digital encoding and preservation: To develop an efficient, high-fidelity means of capturing, processing, distributing, and preserving a collection of more than 1500 original Edison Cylinder recordings; (2) Audio Restoration: To research and design high-quality algorithms for removing distortion artifacts that are inherent to 90 year old recordings.

The first phase of the research was focused to determine the best means of capturing and processing the audio from the phonograph. Every step of the signal chain was examined and constructed to maintain the highest fidelity.

Computer AD Conversion Microphone

The signal begins with an original hand-cranked Edison phonograph, nearly 100 years old. All capture was done by microphones and digitally captured at 44.1 kHz, and 16 bit CD recorder. Various pickup patterns were auditioned in quality. Digital editing was completed with Wavelab, Matlab, SoundForge, and Protools with bit encoding at 48 kHz.

Processing

Each recording received a mix of: noise reduction, click removal, equalization, pitch correction, adjustments for eccentricity, and dynamic range compression. The recordings were converted to .MP3 format for Internet distribution, and cataloged in a detailed database at CCRMA. A wide array of tests examined each component in the signal chain to create the best combination of equipment and tools. For example, it was discovered, that a stereo microphone configuration placed 1.5 meters from the phonograph captured 5 dB less noise (around 1730 Hz) than a high-proximity microphone at 10 cm. While this configuration helps to mitigate noise, the stereo recordings felt more distant to some listeners, who preferred a close microphone with acoustic dampening.

Analysis showed that the phonograph produced no significant content above 4 kHz. In addition, content below 80 Hz was negligible. Thus data compression algorithms and a bandpass filter were selected to deliver only the relevant content to the listener, resulting in a smaller file size for faster distribution over the web. The final system integrated the results of these and many other measurements at all points in the signal chain to capture the highest quality sound possible.

The second phase of this research project aimed to develop a novel method to reduce the "pops" and "clicks" (very brief distortions caused by dirt and scratches) that are inherent to phonograph recordings. These signal distortions are eliminated through two primary processing steps: (1) detection of the signal distortion; (2) replacement of the distorted sound with an interpolated estimation.

Matlab was used to create algorithms that effectively detect substantial distortions, and splice good data from surrounding areas such that there are no signal discontinuities in the new waveforms.

Performance Analysis

In reconstructing the performance we measured and compared various temporal aspects of Brahms' playing. Since the dance uses a limited number of rhythmic patterns we subdivided the
data according to rhythmic types. The most recurrent of these is the dotted-quarter/eighth-note measure unit. There are sixteen recurrences of this unit in four consecutive six-measure phrases. Each of these phrases culminates with a half note accompanied by arpeggiation. Where ambiguities occurred, knowledge of Brahms' style

was applied.

Summary

This research project accomplished the following two goals: (1) Digital encoding and preservation: An efficient, high-fidelity means of capturing, processing, distributing, and preserving a collection of more than 500 original Edison cylinders was developed. Files are posted at the CCRMA website; (2) Audio Restoration: A method for removing signal distortion was created. A foundation has been built on which to develop more robust algorithms. This data was used to reconstruct the entire, original four hand version of the piece in MIDI format playable on an acoustic reproducing piano such as the Disklavier.

Although the recording technology lacked the sensitivity to derive dynamics or pedal markings, the timings suggested distinct performance trends that used to create a good approximation of how Brahms would have played the piece. For the first time ever this historic musical document has been accurately deciphered. This endeavor included aspects of musicology, mathematics, software and hardware engineering and detective work. The project involved developing a de-noising method, painstaking removal of layers of the recording in order to reveal music 'hidden' within the noise, and reconstruction of the analyzed and transcribed layers. This was a project in Sonic Archeology: An analysis and transcription of the 1889 cylinder recording of Johannes Brahms performance of a segment of his First Hungarian Dance.

Successfully straddling technology and art, the completed refurbished performance is playable on an acoustic reproducing piano such as Yamaha's Disklavier. In effect, it recreates Brahms himself playing. As for Cigar Bill's collection, in keeping with his wishes, it is available for undergraduate and graduate research. Learning from Berger's work and pioneering their own methods, students are cataloging and restoring the recordings so that eventually they will be available on-line for the general public to enjoy.

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  Stanford, CA 94305-8180

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- Allen Koenigsberg's History of Recordings links
- Edison Sound Recordings at the Library of Congress
- Edison National Historic Site
- Berger, Ciofman, and Goldberg, 1994
- Scott Cannon- 2002 EE REU Program Edison Revisited; http://ccrma-www.stanford.edu/groups/edison/

Appendix IV

Amarili, mia bella
Music Example Used in Chapter 1

Excerpt from Twenty-Four Italian Songs and Arias
of the Seventeenth and Eighteenth Centuries

8

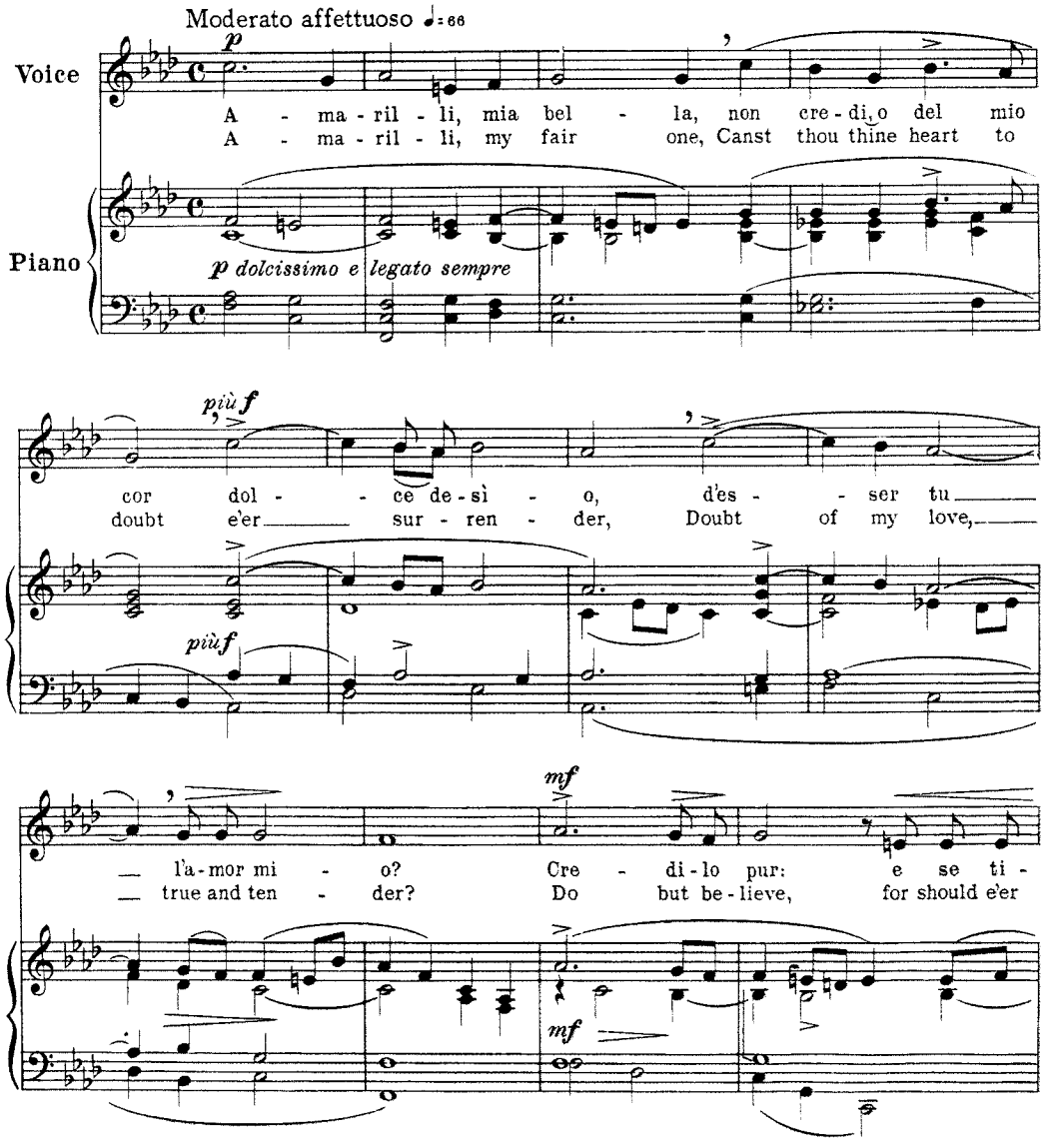
Amarilli, mia bella

Amarilli, my fair one

Madrigal

English version by
Dr. Theodore Baker

Giulio Caccini
(1546-1618)



Bibliography

The goal of this bibliography is to make available a current list of sources of information pertinent to music technology. As with all forms of technology, this list becomes dated the moment it appears, but will serve as a starting point for further investigation. Listed in the first section of the work are a few bibliographic works that followed similar lines of study. This work expands on those and duplication in entries between the bibliographies is limited to works that have been updated since their publication. Examining those bibliographies would be a necessary part of any investigation of music technology material dating before 1997, the year of publication of *Electronic and Computer Music: An Annotated Bibliography* [see Robert L. Wick].

This bibliography is not a complete listing of all aspects of music technology. With the vast array of areas that technology impacts in music, certain areas are not present within this work. This work centers on music technology as it relates to computers. Works specific to instruments, such as synthesizers, have been left out unless they have clear references to their relation to computer technology. Recording technology has been largely left out. Within this work, some books were either too new or difficult to obtain during the course of study. They were, however, listed on the Internet with short descriptions of the work and therefore deserved mention. Any item that is listed but was not examined by the author will have a " * " before the entry. Any omission of works that should be listed is unintentional and occurred due to the time constraints of finishing this project.

Bibliographies/Dictionaries

Carlsen, James C. and **David Brian Williams**. *A Computer Annotated Bibliography: Music Research in Programmed Instruction: 1952-1972*. Reston, VA: Music Educators National Conference, 1978. [iii], 71 pp., index by topic.

This book might be useful for historical research. All entries are annotated.

Cross, Lowell M. *A Bibliography of Electronic Music*. Toronto, Canada: University of Toronto Press, 1967. [vi], vii-ix, 126 pp.

Dobson, Richard. *A Dictionary of Electronic and Computer Music Technology: Instruments, Terms, Techniques*. New York: Oxford University Press, 1992. [ix], x, 224 pp., Appendix 1: Binary and Hexadecimal Conversion Table; Appendix 2: MIDI Commands; Appendix 3: Scale and Frequency Tables, Index of Products and Manufacturers, Index of Names, General Index.

Kostka, Stefan M. *A Bibliography of Computer Applications in Music*. Hackensack, NJ: Joseph Boonin, Inc., 1974. [ii], iii, 58 pp.

This bibliography is number seven in the *Music Indexes and Bibliographies* series edited by George R. Hill. Useful for possible historical research as all entries are published prior to 1974.

Tjepkema, Sandra L. *A Bibliography of Computer Music: A Reference for Composers*. Iowa City, IA: University of Iowa Press, 1981. [ix], x-xvii, 276 pp.

This is an annotated bibliography that includes articles in publications, though it is out-of-date.

Wick, Robert L. *Electronic and Computer Music: An Annotated Bibliography*. Westport, CT: Greenwood Press, 1997. [ix], x-xiii, [i], 198 pp., Appendix A: Theses and Dissertations; Appendix B: System Manuals; Appendix C: On-Line Sources; Appendix D: Electronic and Computer Music Periodicals, Name Index, Subject Index.

This is a complete and well-annotated bibliography of music technology material through the mid 1990's. It is a very complete work that began while Mr. Wick was developing a basic library for the University of Colorado at Denver's Department of Music. The information included in the book is separated into well thought-out categories. While there are some articles from publications included, they are very sparse. Also, the online source section is small and rather out of date given the explosion of the Internet in the years since it's publishing.

Books

Alexander, Peter L. *How MIDI Works*. 6th ed. Caroline J. Whitear, ed. Milwaukee, WI: Hal Leonard Corporation, 2001. iv-xiv, 402 pp.; Appendix 1: More Soft Instruments; Appendix 2: Effect Plug-ins.

> This book is a comprehensive look at MIDI and all its uses in music. The chapters are organized into easy to read sections with many illustrations.

Balaban, Mira, Kemal Ebcioglu, and **Otto Laske**, eds. *Understanding Music with AI: Perspectives on Music Cognition.* Menlo Park, CA: The AAAI Press and Cambridge, MA and London: The MIT Press, 1992 [Released by jointly by both publishers]. [v], vi-xxxviii, [3], 4-512 pp., 765-item bibliography (reference material follows each chapter), notes follow selected chapters.

> This book is a collection of articles concerning artificial intelligence (AI). Subject matter includes musicology, composition, analysis, performance, perception, and learning and tutoring.

Beattie, Rob. *Playing Music on Your PC: The Multimedia PC- Music CDs - MP3 - Player Programs - Downloading Music Files - Portable MP3 Players - Compilations.* New York: Dorling Kindersley Publishing Inc., 2000. 6-72.

> As comprehensive as the title sounds, this very short book is just a rough overview of working with recorded music on a PC.

Berz, William L. and **Judith Bowman**. *Applications of Research in Music Technology.* Reston, VA: Music Educators National Conference, 1994. [iv], v, 90 pp., 278-item bibliography, glossary.

> A good, but short, discussion on the use of computer technology in education.

Bowen, Jeff. *Becoming a Computer Musician.* Indianapolis, IN: SAMS Publishing, 1994. Inside cover includes material, [v], vi-xx, [1], 2-258, [vi] pp., includes CD-ROM (inside back cover), Appendix A: Programs That Teach Music; Appendix B: Printed Score Samples; Appendix C: General MIDI Sound Tables; Appendix D: Table of MIDI Events; Appendix E: The Resource Guide; Appendix F: Contents of the *MusicPower* CD-ROM.

> Though some of the material is out-of-date, the book as a whole offers a good overview of music technology with many examples of its uses.

Brinkman, Alexander R. *PASCAL Programming for Music Research.* Chicago and London: The University of Chicago Press, 1990. [vi], vii-xxii, [2], 3-963 pp., Appendix

A: The ASCII Character Set; Appendix B: Type Compatibility and Operator Precedence; Appendix C: A DARMS Interpreter; Appendix D: A Program Library; Appendix E: Score Programs From Chapter 20, glossary, index to Programs, Subprograms, and Algorithms, general index.

Brook, Barry S. ed. *Musicology and The Computer: Musicology 1966-2000: A Practical Program.* New York: The City University of New York Press, 1970. [iv], insert – correction page, v-x, 275 pp., 617-item bibliography, subdivided into VII categories.

> While the title implies that this book has a historical timeline of the use of computers in musicology over a thirty-four year span, it is a collection of symposium transcripts that all date from April and May of 1966. The extent of its relevance to the year 2000 is confined to the imagination of the participants and what they believe will occur in the following decades. However, that does not diminish the usefulness of this book. Given that the mid-1960's are the dawn of computer use in music, this book offers a window into the thought process of the scholars and computer savvy people of the day. There discussion of the problems associated with transferring the information in music into the number type data of computer languages and the hesitancy of scholars of the day to use the new technology are important for a historical discussion of computers and music. The look and feel of early music/computer interaction is well described in the pages of this book.

Camp, Victoria. *Making Music on Your PC.* Grand Rapids, MI: Abacus, 1997. v-xx, 5-348 pp., CD-ROM, Appendix A: Glossary.

> This book is a cursory look at creating music on a PC with some information out-of-date.

Chadabe, Joel. *Electric Sound: The Past and Promise of Electronic Music.* Upper Saddle River, NJ: Prentice Hall, 1997. [iv], v-xiv, 370 pp., 338-item list of notes and source material.

> This book is good source material for computer and electronic music through 1997.

Choksy, Lois, Robert M. Abramson, Avon E. Gillespie, David Woods, and **Frank York**. *Teaching Music in the Twenty-First Century.* 2nd ed. Upper Saddle River, NJ: Prentice Hall, 2001. [ii], iii-x, 342 pp.

> A good book on general education in elementary and middle school, this book contains a chapter dedicated to "Technology and Music Education."

Cook, Perry R. ed. *Music, Cognition, and Computerized Sound: In Introduction to Psychoacoustics*. Cambridge, MA and London, England: The MIT Press, 1999. [v], vi-xi, 372 pp., CD, 229-item bibliography (bibliographies follow each chapter), Appendix A: Suggested Lab Exercises; Appendix B: Questions and Thought Problems; Appendix C: Sound Examples on CD.

> This book is a compellation of different authors, each having been a lecturer on their specific topic in the course in psychoacoustics offered at Stanford University at the Stanford Center for Computer Research in Music and Acoustics.

Cope, David. *The Algorithmic Composer*. Madison, WI: A-R Editions, Inc., 2000. [v], vi-xiii, 302 pp., CD-ROM, 110-item bibliography, Appendix: The CD-ROM.

> "*The Algorithmic Composer* is designed to complete a trilogy of books of which *Computers and Musical Style* and *Experiments in Musical Intelligence* constitute the first two volumes."

Cope, David H. *New Directions in Music*. Dubuque, IA: Wm. C. Brown Company, 1981. xi, 362, i pp., 36-item bibliography, Appendix I: Glossary of Terms, Appendix II: Biographical Data, Appendix III: Notations, Appendix IV: Source Addresses.

> *New Directions* covers many areas of modern music and includes detailed chapters on "Electronic Music" and "Computer Music."

Dodge, Charles and **Thomas A. Jerse**. *Computer Music: Synthesis, Composition, and Performance*. 2nd ed. New York: Schirmer Books, 1997. [iv], v-xv, [iii], 455 pp., 348-item bibliography (each section has its own bibliography).

> This book centers mostly on analytical discussion of the workings of synthesizers and older computer programs. (Note: This book is included in the Wick's bibliography, but is included here as well because of the 1997 update.)

Eargle, John M. *Music, Sound, and Technology*. New York: Van Nostrand Reinhold, 1990. [iv], v-xii, 290 pp., bibliographical entries follow each chapter with overlaps, 150-item [repeats eliminated].

> This book is primarily about sound. How instruments produce sounds; how sound is transmitted; how orchestra set up effects sound. It deals with the physics of sound, the mechanics of instruments, and the changes in technology in instruments. There is a fairly detailed section on sound transmission within a given space, from music halls to living rooms. An entire chapter is dedicated to sound reproduction in the home and another to the principles of sound recording.

The final section introduces electronically created sounds. It does seem odd to separate synthesized musical instruments from the other sections on instruments, but perhaps the author feels the need to completely explain how sound is produced and manipulated in the physical realm before explain its manipulation electronically.

Edstrom, Brent. *Making Music with Your Computer,* 2nd ed. Vallejo, CA: EM Books, 2001. [iv], 458 pp., CD-ROM, Appendix A: Jeff Casey, "Electronic Euphoria," *Electronic Musician,* February 1999; Appendix B: Philip De Lancie, "Mastering on a Budget," *Electronic Musician,* October 1998; Appendix C: Dennis Miller, "The Sound Design Studio," *Electronic Musician,* June 1999; Appendix D: David Rubin, "The Music for Picture Studio," *Electronic Musician,* June 1999; Appendix E: Gino Robair and Jeff Casey, "The Music CD Production Studio," *Electronic Musician,* June 1999.

This book includes quite a bit of instruction on music theory and composition. There is some program specific information (PC only) and basic MIDI instruction.

Gallagher, Mitch ed. *Make Music Now!* San Francisco: Backbeat Books, 2002. [ii], v-viii, 181 pp.

This book is designed to address the needs of a person attempting to set up a home music studio. The chapters are simple and easy to follow. While the books primary aim is recording, there are large sections discussing MIDI, computers and keyboards, and software and hardware.

***Garrigus, Scott R.**[1] *Sonar 3 Power!* 3rd ed. [Boston, MA]: Muska & Lipman/Premier-Trade, 2003. 480 pp.

[From Amazon.com] "SONAR 3 Power!" will take you deep into the many features that this amazing software package offers. You will get more than just a quick rundown of tools and buttons. You will learn how to truly get the most out of SONAR 3 as you work your way through step-by-step examples and exercises that will help make your composing and recording sessions run more smoothly. You will cover the major features, but you will also get tips on the more obscure elements of SONAR and learn how to make all of the features work together seamlessly. It's all here, tips for customizing SONAR 3, techniques for recording multiple tracks at once, and instructions that simplify mixing. Unleash the power of SONAR 3!

Glinsky, Albert. *Theremin: Ether Music and Espionage.* Chicago: University of Illinois Press, 2000. ix-xvi, 403 pp.

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[1] All items listed that were unavailable for examination are marked with an *.

This book is an in depth exploration into the life and work of Leon Theremin, inventor of the Theremin musical instrument.

Grebler, Eric. *Digital Performer 4: Ignite!* Boston, MA: Muska and Lipman Publishing, 2004. ix-xix, 314 pp., appendix (Review Questions).

Mr. Grebler examines all of the basic aspects of using Digital Performer in a book full of examples using screenshots from the computer.

***Guérin, Robert.**[2] *Cubase SL/SX Power!* [Boston, MA]: Muska and Lipman/Priemer-Trade, 2004. 520 pp.

[From Amazon.com] "Cubase SX/SL 2 Power!" goes in-depth with the most important features of Cubase SX and SL 2. You will also learn some of the lesser-known features that will allow you to take advantage of everything this impressive software has to offer. You will cover the Freeze function, an attractive new addition to this version of Cubase that allows you to render VST instrument tracks temporarily to save CPU power. This book gives you the tips you need to get the most out of this exciting tool. Much more than a simple encyclopedia of Cubase features and functions, "Cubase SX/SL 2 Power!" teaches you why you should use specific features and when they are most beneficial to your project. As you work your way through, put your newfound skills to the test by completing several online exercises. Harness the power of Cubase SX and SL 2!

***Guérin, Robert.**[3] *MIDI Power!* [Boston, MA]: Muska and Lipman/Priemer-Trade, 2002. 376 pp.

[From Amazon.com] From how MIDI works, to how to connect devices through it, to how it integrates into a computer environment, "MIDI Power!" is a comprehensive reference guide to MIDI. You will get an in-depth look at MIDI, its messages and protocols and acquire the information you need to navigate it with comfort and ease. Whether you're a beginner who just wants to make sense of MIDI or a veteran wanting to realize its full potential, "MIDI Power!" will help you produce professional music now and in the future.

Hacker, Scot. *MP3: The Definitive Guide.* Sebastopol, CA: O'Reilly and Associates, Inc., 2000. v-x, 388 pp., Appendix: ID3ul Genres.

This is a complete look into working with MP3's, including CD burning, web casting, and Internet distribution.

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[2] All items listed that were unavailable for examination are marked with an *.
[3] Ibid.

Harris, Craig R. and **Stephen T. Pope** eds. *Computer Music Association Source Book: Activities and Resources in Computer Music.* [San Francisco, CA]: Computer Music Association, 1987. [vi], 246, [ii] pp., indices: CMA Membership, Publications Order, and Survey Forms.

> This book contains a small collection of articles. The majority of the book is a series of lists of member data and resource lists. One interesting section that might yield information for research is "Part 7: Tables of Contents of Recent International Computer Music Conference Proceedings."

Hart-Davis, Guy and **Rhonda Holmes.** *MP3!: I Didn't Know You Could Do That . . .* Alameda, CA: Sybex Inc., 1999. ix-xviii, 269, [1] pp., CD-ROM.

> The authors describe MP3 playing, managing, publishing, burning, and Internet related issues. Some of the material is out of date.

Hewlett, Walter B. and Eleanor Selfridge-Field. *Computing In Musicology: An International Directory of Applications.* Vol. 10. Stanford, CA: Center for Computer Assisted Research in the Humanities, 1996. [ii], i-viii, [2], 3-235, [xi] pp., 84-item bibliography.

> The book is a listing and review/discussion of software available in 1995-1996 for use in musicology. Most of the software is out of date, though some are still in use in newer versions.

Hill, Brad. *Going Digital: A Musician's Guide to Technology.* New York: Schirmer Books, 1998. [iv], v-xxiii, 256 pp., Glossaries follow each section, Resource List.

A good general guide to technology, though not very specific. The information includes is a bit out of date.

Hiller, Lejaren A., Jr. and **Leonard M. Isaacson**. *Experimental Music: Composition With an Electronic Computer.* Westport, CT: Greenwood Press, Inc., 1979. First published: New York: McGraw-Hill, 1959. [iv], v-vii, 197 pp., Appendix: Full Score of the *Illiac Suite.*

> Out-of-date material.

Hoffer, Charles R. *Teaching Music in Secondary Schools.* 5th ed. Belmont, CA: Wadsworth/Thomson Learning, 2001. [viii], ix-xxii, [xxiii], 283 pp., Appendix A: The Music Code of Ethics; Appendix B: Additional Readings, [Bibliography – 25-item general music, 16-item choral music, 9-item general music, 13-item instrumental music]; Appendix C: Instructional Computer and Video Materials.

This book is primarily a general guide to teaching music in secondary schools. There is a small section outlining the use of technology in nonperformance courses. Appendix C contains a good list of music programs that are applicable to teaching music.

Hofstetter, Fred T. *Computer Literacy for Musicians.* Englewood Cliffs, NJ: Prentice Hall Inc., 1988. v-xvi, 351 pp., 72-item bibliography.

This book is a comprehensive look at computers uses in music education. Given that the book was written in 1988, most of the programs listed are out of date or have been upgraded. There are chapters concerning how to purchase computers and software that are still relevant to some extent.

Huber, David Miles. *The MIDI Manual: A Practical Guide to MIDI in the Project Studio.* 2nd ed. Woburn, MA: Focal Press, 1999. v-xii, 255 pp., Appendix A: The MIDI 1.0 Specification; Appendix B: The MIDI Implementation Chart; Appendix C: Continued Education.

Johnson, Mark. *Finale Power!* Cincinnati, OH: Muska and Lipman Publishing, 2002. v-xvi, 422 pp., CD-ROM.

This book is a guide to using Finale software.

Jungleib, Stanley. *General Midi.* Madison, WI: A-R Editions, Inc., 1995. [v], vi-xix, 234 pp. + floppy disk, Appendix 1: Directory; Appendix 2: Further Reading (10-items); Appendix 3: Sound Canvas Voice Definitions, References (7-item bibliography).

Mash, David S. *Computers and the Music Educator.* Melville, NY: Sound Tree, 1996. [3], 6-102 pp., floppy disk.

Given that the book was written in 1996, much of the software and hardware is out of date, having been replaced by newer versions or different programs. The concepts presented are very up to date. Section I introduces the reader to the basics of technology in music. Section II looks at the possible uses for that technology in the classroom and as a teaching resource. Section III is a reference section for actual devices and programs. For a short book, it offers a large amount of information.

Lehrman, Paul D. and **Tim Tully.** *MIDI for the Professional.* New York: Amsco Publishing, 1993. 7-239 pp.

The authors have put together a comprehensive guide to MIDI, though, given the age of the book; much of the software that is referenced is out of date.

***Merton, Orren.**[4] *Logic 6 Power!* [Boston, MA]: Muska and Lipman/Priemer-Trade, 2003. 448 pp.

> [From Amazon.com] "Logic 6 Power!" is a one-of-a-kind, comprehensive guide to the many features of Logic 6. It serves as a complete introduction and reference to the most commonly used features, explaining then simply, thoroughly, and completely. Begin with the basics of Logic--comprehensive introductions to digital audio, MIDI, and sequencing. Then you're ready to jump in and examine the heart of Logic 6! Get ready to compose, record, and edit your own music like a pro. Work your way through each feature just as you would complete an actual Logic project. Cover everything from initially setting up Logic to mixing down your song, saving it, and organizing your files. Wrap up with coverage of advanced topics including synchronizing hardware and working with video. Put the power of Logic 6 to work for you!

Messick, Paul. *Maximum MIDI: Music Applications in C++*. Greenwich, CT: Manning Publications Co., 1998. xix, 453 pp., CD-ROM, Appendix A: The MIDI ToolKit APIs; Appendix B: MaxMidi DLL Source Code; Appendix C: MaxMidi C++ Classes Source Code; Appendix D: MidiSpy, SxLib, and MaxSeq Source Code.

> A book designed for someone interested in programming MIDI applications on a Windows based computer. "I found myself frustrated by the obstinate, poorly documented, and woefully inadequate MIDI functions available to me as a Windows programmer. So, I set out to write a set of routines that would allow me to write music applications without sweating the MIDI details."

Middleton, Chris. *The Complete Guide to Digital Audio: A Comprehensive Introduction to Digital Sound and Music-Making*. Boston, MA: Muska and Lipman Publishing, 2003. 6-192 pp.

> This book is an easy to read, basic guide to music technology. It is full of large pictures and examples.

Miranda, Eduardo Reck, ed. *Readings in Music and Artificial Intelligence.* Amsterdam: Harwood Academic Publishers, 2000. [v], vi, [vii-ix], x, [1], 2-294, [i] pp., list of Contributors, each article contains its own bibliography – 479 item total (with some overlap).

> This book is a collection of scholarly articles on the subject of artificial intelligence and music. The articles included are: "Regarding Music, Machines, Intelligence and the Brain: An Introduction to Music and AI [Artificial

[4] All items listed that were unavailable for examination are marked with an *.

Intelligence]" - Eduardo Reck Miranda, "Music, Intelligence and Artificiality" - Alan Marsden, "Musical Knowledge: What can Artificial Intelligence Bring to the Musician?" - Geraint Wiggins and Alan Smaill, "Symbolic AI Versus Connectionism in Music Research" - Petri Toiviainen, "On the Potential of Machine Learning for Music Research" - Gerhard Widmer, " Computer Analysis of Jazz Chord Sequences: Is *Solar* a Blues?" - François Pachet, "Musical Pattern Extraction and Similarity Assessment" - Pierre-Yves Rolland and Jean-Gabriel Ganascia, "Interactive Music Systems in Ensemble Performance" - Robert Rowe, "Artificial Intelligence Architectures for Composition and Performance Environments" - Antonio Camurri, "Dynamic Programming for Interactive Music Systems" - Roger Dannenberg, "The Mechanization of Intelligence and the Human Aspects of Music" - Carlos Gustavo Guerra, "Artificial Intelligence and Music Education" - Brian Smith, "Artificial Intelligence in Music Education: A Critical Review" - Simon Holland. These articles push the edge of music's relationship with computers. The use of "thinking" computers to assist or replace human thought is taking humanity into the realm of science fiction. "Music is generally associated with the expression of emotions, but the intellect also plays an important role in music activities. The interplay between these two elements feature in the research agendas of a variety of scientific fields, including Neuroscience, Cognitive Sciences, and Artificial Intelligence (AI)." While the thought of AI in educating musicians may seem like a far-fetched idea, the use of computers aiding in education is already being applied. Programs, like *Practica Musica,* an ear training and theory training program, are already in regular use in music schools. While this might not be quite a "thinking" program, it is a computer-training program, which introduces new subject matter based on a student's progress through a series of exercises.

Morgan, Robert P. *Twentieth-Century Music: A History of Musical Style in Modern Europe and America.* New York, NY: W.W. Norton & Company, 1991. xvii, 554 pp, 738-item bibliography

This book details music history of the Twentieth-Century and contains one chapter on technology.

*** Moschovitis, Christos J.P., et al.**[5] *History of the Internet: A Chronology, 1843 to the Present.* Santa Barbara, CA: ABC-CLIO, 1999.

Note: This book was not examined physically, but excerpts from the book were consulted and are available online at <http://www.historyoftheinternet.com/>.

Ness, Robyn. *SAMS Teach Yourself Mac OS X Digital Media: All in One.* Indianapolis, IN: Sams Publishing, 2003. vi-xxi, 2-763 pp.

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[5] All items listed that were unavailable for examination are marked with an *.

The areas of digital media relating to music contained in this book are limited to MP3 programs and CD burning. This book contains quite a bit of information that does not pertain to music.

Newhouse, Ben. *Producing Music with Digital Performer.* Boston, MA: Berklee Press, 2004. iv-viii, 222 pp.

Mr. Newhouse is an associate Professor at the Berklee School of Music. His book covers the latest version of Digital Performer (ver. 4). While not as extensive as the user manual that comes with the program, this book is much easier to read and follow while learning Digital Performer.

Noad, Frederick. *The Virtual Guitarist: Hardware, Software, and Websites for the Guitar.* New York: Schirmer Books and London: Prentice Hall International, 1998. [vi], vii-xv, 220 pp., Appendix: Music Notation Programs.

This book is unusual in its focal point. While *The Virtual Guitarist* would appear and, in fact, is created for the guitarist, the electric guitar on the cover is misleading. The book was written by and for the classical guitarist. In that vain, this book is different than most books on electronic music, which tend to center on computers in relation to keyboard and recording. This book does look extensively at those areas as well, but from the perspective of a guitar player. Given that it is already six years old, all of the programs tend to be either upgraded extensively since or extinct. Additionally, the hardware has also evolved quite a bit in the ensuing years. The websites listed may also be dated but some might still be useful. The books main use would be as a change in focal point for guitarists wishing to expand musically in computers and could be a stepping-stone onto newer technologies of the same sort.

Phillips, Dave. *Linux Music and Sound: How to Install, Configure, and Use Linux Audio Software.* San Francisco, CA: No Starch Press, 2000. viii-xxii, 399 pp., 49-item bibliography.

This is a comprehensive Linux audio guide that includes information on MP3, real-time software synthesizers, music notation programs, and multi track hard-disk recording and mixing.

Pogue, David. *GarageBand: The Missing Manual.* Sebastopol, CA: O'Reilly Media, Inc., 2004. v-x, 253 pp. Appendix A: The GarageBand Music Crash Course; Appendix B: GarageBand, Menu by Menu; Appendix C: The GarageBand Keyboard Shortcuts.

Another in his continuing series of Missing Manuals, David Pogue's book is the manual that should be included with the program but is not.

***Prager, Michael.**[6] *Reason 2.5 Power!* [Boston, MA]: Muska and Lipman/Priemer-Trade, 2003. 480 pp.

> Put the power of Reason 2.5 to work for you as you produce amazing music. "Reason 2.5 Power!" shows you the ins and outs of this popular program as you work your way through several in-depth tutorials designed to teach you how to use Reason 2.5 to its fullest potential. With this book, you'll dive right in and learn to use Reason to program loops and synths. You'll get detailed tours of the individual Reason devices, including the Mixer, the Subtractor and Malström synthesizers, the Matrix Pattern Sequencer, the Dr:rex Loop Player, the Redrum Drum Computer, and many more. By the time you're finished, you'll be ready to synchronize Reason with other devices, use automation, and mix and publish your creations to CD or the Web. Unleash the power of Reason 2.5!

***Preve, Francis.**[7] *Power Tools for GarageBand: Creating Music with Audio Recording, MIDI Sequencing, and Loops.* San Francisco, CA: Backbeat Books, 2004. 128 pp.

> [From Amazon.com] Apple's GarageBand, the program packaged with every new Mac, is the hottest and most accessible digital music software available today, giving musicians of all levels an affordable tool to perform, record, and create extraordinary sounds. It features thousands of professionally recorded loops, over 50 pro-sounding instruments, effects, and virtual guitar amps. Power Tools for GarageBand teaches pros and aspiring artists how to get the most out of this software - including recording vocals and instruments, creating MIDI sequences, working with Apple loops, customizing software instruments, professional mixing techniques, and time-saving shortcuts. With these power tools in hand, the sonically inclined can create ultraphonic designs.

***Preve, Francis.**[8] *Power Tools: Software for Loop Music.* San Francisco, CA: Backbeat Books, 2004. 166 pp.

> [From Amazon.com] Power Tools: Software for Loops focuses on creating music using samples and loops via popular software tools such as Sonic Foundry's Acid, Ableton Live, and Apple's Soundtrack. The book also covers technical issues specific to sample-based music, such as selecting soundware libraries and sample clearance, as well as mixing, processing, and editing techniques. Finally, the book explores specifics of performing live with these tools, using a laptop or portable computer rig. The accompanying CD-ROM includes free sampled loops and trial versions of software referred to in the text.

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[6] All items listed that were unavailable for examination are marked with an *.
[7] Ibid.
[8] Ibid.

Richard, Albert, ed. *Music and Technology*. Stockholm, Sweden: Unesco, 1970. 206 pp., [ii], bibliographies follow individual articles and are listed here by author, Lesche 9-item p. 55, Koenig 17-item pp. 114-115, Blaukopf 64-item pp. 169-171.

This book is a collection of articles that arose out of a "meeting organized by Unesco . . . with the collaboration of the Fylkingen Society for Contemporary Music from 8-12 June 1970." The articles included in the book are: "Music and Technology in the Europe of 1970" – Werner Kaegi, "Interrogatory of a Musician" - Albert Richard, "Weltanschauung, Science, Technology and Art" - Carl Lesche, "Music and Computers" - Pierre Schaeffer, "The Use of Computer Programmes [sic.] in Creating Music" - Gottfried Koenig, "Synthesis of Sound by Computer and Problems Concerning Timbre" - Jean-Claude Risset, " The Electronic sound Studio of the 1970's" - Max Mathews, "The Training of the Composer in the Use of New Technological Means" - Gustav Ciamaga, "New Technology and the Training of composers in Experimental Music" - Krzysztof Szlifirski, "Space in Electronic Music" - Kurt Blaukopf, "Music and Technology in Japan" - Minao Shibata, "Technology and the Composer" - Herbert Brün, "Unesco Report on the Stockholm Meeting 1970" - Everett Helm. It is a great window into the music technology of the middle of the twentieth-century. The articles examine the effects and uses of technology in music. It delves into early uses of the computer in music, studio electronics, composition training using "new technological means," and other aspects of technology and music. Even though it was written over thirty years ago, (an eternity in the world of technological change), the views expressed are not outdated. "Technology should not be directed towards only one category of composers; it should not be directed towards only one way of thinking. It should leave the composer free to adopt any attitude whatsoever towards his creative activity, and it should allow him considerable choice in the resources which he wishes to use in order to accomplish his work."

Rona, Jeffrey. *The MIDI Companion*. Ronny S. Schiff, ed. Milwaukee, WI: Hal Leonard Corporation, 1994. 96 pp., Appendix 1: Computer Counting Systems; Appendix 2: Glossary; Appendix 3: MIDI by the Numbers.

Rothstein, Joseph. *MIDI: A Comprehensive Introduction*. 2nd ed. Madison, WI: A-R Editions, Inc., 1995. [i]. vi-xvii, [i], 268 pp., Appendix.

A full accounting of the workings of MIDI systems.

Rowe, Robert. *Interactive Music Systems: Machine Listening and Composing*. Cambridge, MA: The MIT Press, 1993. [iii], vi-x, [xi], 278 pp., 125-item bibliography.

Rowe, Robert. *Interactive Music Systems: Machine Listening and Composing.* Cambridge, MA and London: The MIT Press, 1993. [v], vi-x, [i], 278 pp., CD-ROM available (not included with book), 122-item bibliography.

> *Interactive Music Systems* is an accurate title for the book. It describes the world of computer music systems that interact with humans. Not to be confused with programs that perform a task when prompted, notation programs for example, these systems are designed to react to stimuli and produce a reaction to them. The author created the program, *Cypher*, for exactly this purpose. "Cypher is an interactive computer music system that I wrote for composition and performance. The program has two main components: a listener and a player. The listener (or analysis section) characterizes performances represented by streams of MIDI data, which could be coming from a human performer, another computer program, or eve Cypher itself. The player (or composition section) generates and plays musical material." The program's listener is designed to analyze the data provided, in real time, without "matching them against any pre-registered representation of any particular piece of music." The player portion then uses "various algorithmic styles," to respond to the input musically.

Rubin, David M. *The Desktop Musician.* Berkeley, CA: Osborne McGraw-Hill, 1995. [xiv], xv-xx, 430, [12] pp. + CD-ROM, Appendix A: Glossary; Appendix B: Companies to Contact.

> Good information about using computer technology, but most software information is out-of-date.

Rudolph, Thomas E and **Vincent A. Leonard**. *Finale: An Easy Guide to Music Notation.* Boston, MA: Berklee Press, 2002. iii-ix, 758 pp., CD-ROM.

> This book is designed for use as a complete manual for Finale notation software. It covers through version 3.7 of the software.

Rudolph, Thomas E. *Teaching Music with Technology.* Chicago: GIA Publications, Inc., 1996. [ii], iii-iv, 316 pp., 122-item bibliography (bibliographic material follows each section of the book), Notes for each chapter, Appendix A: Publishers and Manufacturers; Appendix B: Publications and Organizations.

> This book covers all aspects of teaching music with computer hardware and software, as well as synthesizers. The breakdown of how to use technology with tips on how best to apply the technology to teaching is easy to follow. A well thought out and well-organized book, its only drawback is being slightly out of date, with more recent software and hardware being excluded. (Note: A new edition is now being published but was unavailable for review.)

Shapiro, Peter, ed. *Modulations: A History of Electronic Music: Throbbing Words on Sound.* New York: Caipirinha Productions, 2000. [iii], iv-vii, [1], 2-254, [i] pp., glossary of terms, artist biographies, author biographies, index of artist/producers, index of song/track titles, index of record/long work titles, index of equipment, index of styles, index of photo credits.

> This book follows the history and breadth of electronic music through a series of articles by various authors and interviews with artists and pioneers. It is the companion book to the film of the same name. The articles included discuss the evolution of taped music, from mono-recording through multi-track recording, the various types of music that use electronics extensively, and interviews with people important to electronic music including Robert Moog (a pioneer in synthesizer technology) and Teo Macero (Miles Davis' producer).

Selfridge-Field, Eleanor. *Beyond MIDI: The Handbook of Musical Codes.* Cambridge, MA and London, England: The MIT Press, 1997. [v], vi-xviii, 630 pp., 143-item bibliography (bibliographic entries are at the end of each section), Appendix 1: The General MIDI Instrument Specification; Appendix 2: Overview of MIDI Extensions; Appendix 3: Code-Translation Programs; Appendix 4: Codes Supported by Optical Recognition Software; Appendix 5: Proposed Musical Characters in Unicode.

Smith, Matt, Alan Smaill, and **Geraint A. Wiggins**, eds. *Music Education: An Artificial Intelligence Approach.* London and New York: Springer-Verlag, 1994. [v], vi-vii, [i], [3], 4-170, [iii], 179-item bibliography (each article contains its own bibliography).

> The book is a series of articles that were derived from a workshop, also titled "Music Education: An Artificial Intelligence Approach." The articles included explore many areas of artificial intelligence (AI) technology in relation to various aspects of education. Described are the uses and aspects of AI in harmony, jazz performance study, human/computer interaction, and cognitive processes.

Suchoff, Benjamin. *A Musician's Guide to Desktop Computing with the Macintosh.* Englewood Cliffs, NJ: Prentice Hall, 1994. [iv], v-xv, 252 pp., glossary, "Vendor Addresses," 29-item bibliography.

> Out-of-date material.

Taylor, Charles. *Exploring Music: the Science and Technology of Tones and Tunes.* Bristol, UK: Institute of Physics Publishing, 1992. [iv] v-ix, 255 pp., 32-item bibliography.

Professor Charles Taylor is a former professor of Experimental Physics at The Royal Institution, Emeritus Professor of Physics at The University of Wales, and was Head of the Department of Physics at University College, Cardiff. He is well known for his demonstration lectures on physics and music, including his televised series "The Royal Institution Christmas Lectures," which ran from 1971 to 1989. This book is a written synthesis of those lectures. Prof. Taylor examines the physics of music in terms that are easily understood by those not scientifically inclined. He discusses the physics of instruments from strings to horns to woodwinds to pianos. There is a section on "Reflections, Reverberation, and Recitals," with a detailed description of how sound moves through space and the effects of various body positions and objects on the sound produced. He looks at wave forms of sound and incorporates the technological aspects of realizing those wave forms through synthesized means. While he does say in the introduction that it is difficult to get the full impact of live physical demonstrations from a written source, his descriptions of experiments and accompanying diagrams and photographs certainly transmit the flavor of his exhibitions.

Temperley, David. *The Cognition of Basic Musical Structures*. Cambridge, MA: The MIT Press, 2001. [i], vi-xvi, 404 pp., 204-item bibliography, notes, appendix: List of Rules.

This book is primarily concerned with how the brain processes information and not about technology. It does, however, contain sections that outline "computational models of contrapuntal analysis" and "experimental and computational work on harmonic." "This book addresses a fundamental question about music cognition: how do we extract basic kinds of musical information – meter, phrases structure, counterpoint, pitch spelling, harmony, and key – from music as we hear it?"

Théberge, Paul. *Any Sound You Can Imagine: Making Music/Consuming Technology*. Hanover, NH: Wesleyan University Press, 1997. 8 pp. with illus., [iv], v-x, 293, [1] pp. 325-item bibliography, notes, background sources.

This book began as the author's doctoral dissertation on the problems involved in modern technology and music. "Recent Innovations in musical technology thus pose two kinds of problems for musicians: . . . they alter the structure of musical practice and concepts of what music is and can be; and . . . they place musicians and musical practice in a new relationship with consumer practices and with consumer society as a whole." The author uses, as an example, the differences between traditional drummers and drum machines. Given that drums are on of the most primitive musical instruments, with almost no moving parts, the ability to make music with a drum rests in the musicians technical abilities to physically evoke sound out of the instrument. Long years of practice to develop coordination and memorize rhythmic patterns make a drummer a musician.

However, in contrast, the drum machine can be controlled using buttons on the front of the instrument or by a computer. The machine contains a series of standard rhythms in various styles of playing, allowing the consumer to "play" the drums almost instantly. While the humanity of playing the drums may not exist in the sounds elicited from the drum machine, it does attempt to replace years of skill and training with electronic means. The author also delves into the socio-economic issues of new technology. "The creation of these new technologies has taken place within the high-intensity market context of contemporary capitalism. An understanding of the various issues relating to music and technical innovation cannot be separated from a broader analysis of contemporary social and economic relations." He describes popular musicians as being "consumers of technology."

Vogel, James and **Nevin B. Scrimshaw**. *The Commodore 64 Music Book: A Guide to Programming Music and Sound.* Boston: Birkhauser Boston, Inc., 1983. [x], 130 pp. + Errata page inserted before contents, 9-item bibliography.

Out-of-date material.

Watkins, Glenn. *Soundings: Music in the Twentieth Century.* New York: Schirmer Books, 1995. xviii, 728 pp.

This book centers on composers of the Twentieth Century and includes one chapter on "Electronics and Explorations of Duration, Timbre, and Space."

***White, Paul.**[9] *Basic MIDI.* London: Sanctuary Press, 2000. 200 pp.

***White, Paul.**[10] *Midi for the Technophobe.* 2nd ed. London: Sanctuary Press, 2002. 202 pp.

Williams, David B. and **Peter R. Webster**. *Experiencing Music Technology: Software, Data, And Hardware.* 2nd ed. Belmont, CA: Wadsworth Group/Thomson Learning, 1999. [ii], v-xxxii, 639, [1] pp., CD, Each section (viewport) contains its own bibliography, 94-items.

David Williams is Associate Dean for Research and Technology in the College of Fine Arts, Director of the Office of Research in Arts Technology, and Professor of Music at Illinois State University. Peter Webster is the John Beattie Professor of Music Education and Director of the Center for Music Technology at Northwestern University's School of Music. The authors have compiled what might be the best current overview of music technology available. They take an in depth look at the history behind current technology, listing the pioneers in the

[9] All items listed that were unavailable for examination are marked with an *.
[10] Ibid.

industry, as well as the evolution of the technology. There are sections dealing with misconceptions concerning music technology and basic computer understanding. They split the book into large sections, for instance, "Computer-Assisted Instruction in Music," and then break that large category into manageable sized sub sections. Included are well-detailed sections on desktop publishing, music notation software, music sequencing and MIDI, creating sounds and music, and authoring systems and multimedia. Each section contains many examples of different software available currently and software that is not current but possible to find in many music computer labs. Most of the software discussed also has an accompanying graphic showing what the student or teacher would find on the computer screen while using the program. The book contains numerous photos of musicians and pioneers in music technology and examples of hardware, past and present. The midi section gives detailed layout graphics for music/computer setups with wiring diagrams explaining how everything is connected. The included CD contains some software demos as well as links to many of the software and information sites available on the Internet. While the book is not a substitute for a book or manual dedicated to a specific piece of software or concept, it is a very complete overview of the current state of music technology and education. Highly recommended.

Periodicals

Computer Music. Editor: Ronan Macdonald. Bath, England: Future Publishing. http://www.computermusic.co.uk

This is a magazine dedicated to computer music, with many reviews of new software and tutorial articles. Each issue includes a CD-ROM.

Computer Music Journal. Editor: Douglas Keislar. Boston, MA: MIT Press. http://mitpress2.mit.edu/e-journals/Computer-Music-Journal/

This journal, from MIT Press, is a longtime scholarly magazine concerned with computer music. The articles are generally written by well-respected scholars in various fields of computer music study and are designed for other scholars.

Future Music. Editor: Andy Jones. Bath, England: Future Publishing. http://www.futuremusic.co.uk

Future music magazine is designed to cover music technology in all realms including many articles reviewing hardware and software. Each article includes a CD-ROM.

Keyboard Magazine. Editor: Ernie Rideout. San Mateo, CA: CMP Information, Inc. http://www.keyboardmag.com

Keyboard magazine is centered around synthesizers and sound modules, as well as musicians using that equipment. There are many articles that discuss and review computer software.

Music Tech Magazine. Editor: Paul Pettengale. Corsham, England: Anthem Publishing Ltd. http://www.musictechmag.co.uk

This magazine offers article and reviews concerning all aspects of music technology, including notation, sequencing, and recording. All issues include a CD-ROM.

Articles in Periodicals

Bokesoy, Sinan and **Gerard Pape.** "Stochos: Software for Real-Time Synthesis of Stochastic Music," *Computer Music Journal,* Vol. 27, No. 3. Cambridge, MA: MIT Press, (Fall, 2003): 33-43.

"Stochos is a real-time stochastic, chaotic, and deterministic event generator implemented as a Max/MSP patch with a unique control interface for assigning stochastic, chaotic, or deterministic curves to different sound transformation and synthesis parameters. It provides a compositional environment with access to a wide range of time scales for these operations. As Stochos is still under development, we will present its current capabilities and our long-term goals for this program. Stochos was designed, programmed, and realized by Sinan Bokesoy in collaboration with Gerard Pape, who conceived and directed the project."

Burdick, Paul and **Lyle Davidson**. "Music, Computers, and Learning at New England Conservatory." In *Technology and Teaching,* ed. Les Lloyd. Medford, NJ: Information Today, Inc., (1997): 303-316.

Paul Burdick, the Music and Computer Studio Director, and Lyle Davidson, the Theory Department Chairperson, both at the New England Conservatory, describe the use of computers in the music department. While the technology used is rather outdated by today's standards, the concepts presented are not. They discuss the space, layout, equipment, and software used in the lab, as well as staffing and funding needs. Their observations of how the studio and by whom the studio is used speaks of the current needs and uses of university computer music labs.

They look at "Working Methods and Dynamics" and the impact of the studio on music learning.

Cope, David. "Computer Analysis of Musical Allusions," *Computer Music Journal,* Vol. 27, No. 1. Cambridge, MA: MIT Press, (Spring, 2003): 11-28.

The author describes using a program called Sorcerer for music analysis. "Sorcerer provides analytical verification of the presence of musical allusions for what I call *referential* analysis, a semiotic approach roughly situated between hermeneutic (interpretive) analysis (e.g., Agawu 1991, 1996; Gjerdingen 1988; Nattiez 1990) and Re´tian (motivic) analysis (Re´ ti 1962)."

Cremaschi, Andrea and **Francesco Giomi**. "*Parrrole*: Berio's Words on Music Technology," *Computer Music Journal,* Vol. 28, No. 1. Cambridge, MA: MIT Press, (Spring, 2004): 26-36.

Through a series of interviews and recollections, the article trace the career of Luciano Berio (1925-2003). As one of the pioneers of the use of music technology in performance and recording, he is an insight into the world of electro-acoustic music.

Di Scipio, Agostino. "On Different Approaches to Computer Music as Different Models of Compositional Design," *Perspectives of New Music*, Vol. 33, No. 1/2. (Winter - Summer, 1995): 360-402. URL: http://links.jstor.org/sici?sici=0031-6016%28199524%2F22%2933%3A1%2F2%3C360%3AODATCM%3E2.0.CO%3B2-Y

The author examines three different approaches to using computers in the compositional process. He and two other composers live in fairly close proximity in the Italian countryside and are working simultaneously on different computer related projects. They are in regular contact with each other, discussing their respective endeavors and the author takes the opportunity to report on their different approaches.

Doornbusch, Paul. "Computer Sound Synthesis in 1951: The Music of CSIRAC," *Computer Music Journal,* Vol. 28, No. 1. Cambridge, MA: MIT Press, (Spring, 2004): 10-25.

This article is a detailed look at early computer music on one of the first "digital" computers.

Ducasse, Eric. "A Physical Model of a Single-Reed Wind Instrument, Including Actions of the Player," *Computer Music Journal,* Vol. 27, No. 1. Cambridge, MA: MIT Press, (Spring, 2003): 59-70.

This is an article that outlines the process of modeling an instrument on a computer. "The objectives of physical modeling are first to ''test the accuracy of the implicit assumptions and structure of the underlying physical model'' with ''simulation[s] of . . . known instrument-player system[s],'' as Keefe (1992) remarks. The second objective is to allow the instrument maker to have an idea of the sound produced by an instrument in a performance situation before the construction of a prototype. The final objective is to be able to design physically unrealizable virtual instruments—for example, a transverse saxophone (Bouasse 1929)—while remaining in a particular timbre space and keeping the aspect of membership in a family of instruments."

Essl, Georg, Stefania Serafin, Perry R. Cook, and **Julius O. Smith.** "Musical Applications of Banded Waveguides," *Computer Music Journal,* Vol. 28, No. 1. Cambridge, MA: MIT Press, (Spring, 2004): 51-63.

The companion article to the one listed below. "In this article, we provide an overview of different musical instruments that have been modeled efficiently using banded waveguides."

Essl, Georg, Stefania Serafin, Perry R. Cook, and **Julius O. Smith.** "Theory of Banded Waveguides," *Computer Music Journal,* Vol. 28, No. 1. Cambridge, MA: MIT Press, (Spring, 2004): 37-50.

"This article describes *banded waveguides*, a way of synthesizing sounds made by solid objects and an alternative method for treating two- and three dimensional objects."

Fitz, Kelly, Lippold Haken, Susanne Lefvert, Corbin Champion, and **Mike O'Donnell.** "Cell-Utes and Flutter-Tongued Cats: Sound Morphing Using Loris and the Reassigned Bandwidth-Enhanced Model," *Computer Music Journal,* Vol. 27, No. 3. Cambridge, MA: MIT Press, (Fall, 2003): 44-65.

"The reassigned bandwidth-enhanced additive sound model is a high fidelity sound representation that allows manipulations and transformations to be applied to a great variety of sounds, including noisy and inharmonic sounds. Combining sinusoidal and noise energy in a homogeneous representation, the reassigned bandwidth-enhanced model is ideally suited to sound morphing and is implemented in the open-source software library Loris. This article presents methods for using Loris and the reassigned bandwidth-enhanced additive model to achieve high fidelity sound representations and manipulations, and it introduces software tools that allow programmers (in C/C^{++} and various scripting languages) and non-programmers to use the sound modeling and manipulation capabilities of

the Loris package."

Gay, Leslie C. Jr. "Acting up, Talking Tech: New York Rock Musicians and Their Metaphors of Technology," *Ethnomusicology*, Vol. 42, No. 1. (Winter, 1998): 81-98. 53-item bibliography. URL: http://links.jstor.org/sici?sici=0014-1836%28199824%2942%3A1%3C81%3AAUTTNY%3E2.0.CO%3B2-J

The author writes about the inherent problems of studying "modern" rock music without taking the technology as the driving force rather than a tool. Even pointing out that musicians acknowledge the over use of technological crutches by saying "too many knobs between the guitar and the amp's speaker," meaning that the number of gizmos and pedals that lie between the instrument and the speaker impede the quality of the sound of the guitar. It is an article that explores the ethnomusicalogical ramifications of technology on music.

Gemmell, Keith. "The *New* Music Business," Music Tech Magazine, Issue 18. Corsham, England: Anthem Publishing Ltd., (October, 2004): 26-34.

The first in a three-part set of articles, the author begins to explain the revolution that the Internet is having on the music industry.

Hirata, Keiji and **Tatsuya Aoyagi.** "Computational Music Representation Based on the Generative Theory of Tonal Music and the Deductive Object-Oriented Database," *Computer Music Journal,* Vol. 27, No. 3. Cambridge, MA: MIT Press, (Fall, 2003): 73-89.

This article discusses the objective and application of using computer programs to evaluate music on a theoretical basis.

Howard, Patricia, Simon Holland, and **Denise Whitelock**. "Sound Investments. Patricia Howard Reviews the Uses of Computers in Harmony Teaching, plus a Round-up of Educational Materials," *The Musical Times*, Vol. 135, No. 1817. (July 1994): 467-468+470-471+473+475.URL: http://links.jstor.org/sici?sici=0027-4666%28199407%29135%3A1817%3C467%3ASIPHRT%3E2.0.CO%3B2-U

The authors discuss computers in their role in teaching harmony, looking especially at a then, just released program, *Harmony Space*. The article also has a list of books and programs designed for teaching theory and harmony, with a short description of each.

Huron, David. "Music Information Processing Using the Humdrum Toolkit: Concepts, Examples, and Lessons," *Computer Music Journal,* Vol. 26, No. 2. Cambridge, MA: MIT Press, (Summer, 2002): 11-26.

This article examines the uses of the program Humdrum. "Five features have accounted for this broad interest: the ability of users to concoct or tailor unique representations that pertain to the user's specific interests; a flexible set of analytic and processing tools that can be applied to both established and user-defined representations; a coherent and extensible system for representing reference-related metadata; ease of connectivity to other existing software; and availability of a large volume of high-quality encoded materials."

Jordà, Sergi. "FMOL: Toward User-Friendly, Sophisticated New Musical Instruments," *Computer Music Journal,* Vol. 26, No. 3. Cambridge, MA: MIT Press, (Fall, 2002): 23-39.

Mr. Jordà examines the possibilities of creating music using simple computer programs. "This article describes an attempt at an integrated conception, called F@ust Music On-Line (FMOL), which is a simple mouse-controlled instrument that has been used on the Internet by hundreds of musicians during the past four years."

Loy, Gareth. "The CARL System: Premises, History, and Fate," *Computer Music Journal,* Vol. 26, No. 4. Cambridge, MA: MIT Press, (Winter, 2002): 52-60.

A member of the CARL (Computer Audio Research Laboratory) at the University of California, San Diego, the author describes the evolution of their system of music programming.

Lyon, Eric. "Dartmouth Symposium on the Future of Computer Music Software: A Panel Discussion," *Computer Music Journal,* Vol. 26, No. 4. Cambridge, MA: MIT Press, (Winter, 2002): 13-30.

This article is a transcription of the panel discussion moderated by Eric Lyon.

McCartney, James. "Rethinking the Computer Music Language: SuperCollider," *Computer Music Journal,* Vol. 26, No. 4. Cambridge, MA: MIT Press, (Winter, 2002): 61-68.

The author discusses the creation of a new computer music language.

Miranda, Eduardo Reck. "Emergent Sound Repertoires in Virtual Societies," *Computer Music Journal,* Vol. 26, No. 2. Cambridge, MA: MIT Press, (Summer, 2002): 77-90.

Mr. Miranda discusses the evolution of music based on autonomous music programs creating music through interaction with each other.

Mortensen Wanderley, Marcelo and **Nicola Orio**. "Evaluation of Input Devices for Musical Expression: Borrowing Tools from HCI," *Computer Music Journal,* Vol. 26, No. 3. Cambridge, MA: MIT Press, (Fall, 2002): 62-76.

Given that computers have become an easily accessible tool for music creation, the authors examine the input devices available for real-time input of expression.

Pardo, Bryan and **William P. Birmingham.** "Algorithms for Chordal Analysis," *Computer Music Journal,* Vol. 26, No. 2. Cambridge, MA: MIT Press, (Summer, 2002): 27-49.

The authors examine computer algorithms that are capable of analyzing the chord changes in a musical piece.

Phillips, Dave. "Computer Music and the Linux Operating System: A Report from the Front," *Computer Music Journal,* Vol. 27, No. 4. Cambridge, MA: MIT Press, (Winter, 2003): 27-42.

"The purpose of this article is to introduce readers to Linux and to describe the factors that make this operating system attractive to computer musicians."

Puckette, Miller. "Max at Seventeen," *Computer Music Journal,* Vol. 26, No. 4. Cambridge, MA: MIT Press, (Winter, 2002): 31-43.

The author discusses the program group Max. "Three currently supported computer programs—Max/MSP, jmax, and Pd—can be considered as extended implementations of a common paradigm I refer to here as 'Max . . .' The Max paradigm can be described as a way of combining pre-designed building blocks into configurations useful for real-time computer music performance."

Robson, Dominic. "PLAY!: Sound Toys for Non-Musicians," *Computer Music Journal,* Vol. 26, No. 3. Cambridge, MA: MIT Press, (Fall, 2002): 50-61.

Mr. Robson looks at the creation of simple, computer controlled instruments designed for the non-musician.

Sanders, Paul. "Technology in Music Education," *The Musical Times*, Vol. 133, No. 1795. (Sep., 1992): 440-441. URL: http://links.jstor.org/sici?sici=0027-4666%28199209%29133%3A1795%3C440%3ATIME%3E2.0.CO%3B2-5

In a letter to the editor, Mr. Sanders outlines the possibilities and the pitfalls of music technology in music education. Through his perspective, the reader can see that technology can be a wonderful, useful tool to assist in a student's classical music education, but that to replace other forms of music education with technology is to abandon those things that help create a well-rounded musician. "There is a Taoist epigram which says, 'A wheel has thirty spokes; it is the hole in the center that makes it useful.' It seems a shame, just as technology is providing access to the mysteries of music, that we should be considering throwing out spokes and wheel, in vain belief that the hole will function by itself."

Selfridge-Field, Eleanor. "Reflections on Technology and Musicology," *Acta Musicologica*, Vol. 62, Fasc. 2/3. (May - Dec., 1990): 302-314.
URL: http://links.jstor.org/sici?sici=0001-6241%28199005%2F12%291%3A62%3A2%2F3%3C302%3AROTAM%3E2.0.CO%3B2-X

The article examines the role of technology in the research of music.

Scaletti, Carla. "Computer Music Languages, Kyma, and the Future," *Computer Music Journal,* Vol. 26, No. 4. Cambridge, MA: MIT Press, (Winter, 2002): 69-82.

The author, as an evolution from Eric Lyon's panel discussion ["Dartmouth Symposium on the Future of Computer Music Software: A Panel Discussion"], explores the world of different computer music languages.

Ulyate, Ryan and **David Bianciardi.** "The Interactive Dance Club: Avoiding Chaos in a Multi-Participant Environment," *Computer Music Journal,* Vol. 26, No. 3. Cambridge, MA: MIT Press, (Fall, 2002): 40-49.

Given the opportunity to design an interactive music system for the 25th annual ACM SIGGRAPH Conference on Computer Graphics and Interactive Techniques, the authors chose to create a program that allowed dancers in a club to interact with an audio/visual display.

Välimäki, Vesa, Mikael Laurson, and **Cumhur Erkut.** "Commuted Waveguide Synthesis of the Clavichord," *Computer Music Journal,* Vol. 27, No. 13. Cambridge, MA: MIT Press, (Spring, 2003): 71-82.

Given the volume limitations inherent in the clavichord, the authors attempt to accurately recreate the sound of the clavichord electronically to enable the use of the instrument in a modern setting, allowing for a change in volume without a change in timbre.

Webster, Peter R. "Creative Thinking, Technology, and Music Education." In *Assessing the Role of Technology in Education,* ed. Dan H. Wishnietsky. Bloomington, IN: Phi Delta Kappa, (1994): 149-155.

The article by Mr. Webster, a professor of music education at Northwestern University, centers on his ideas concerning "Creative Thinking." His discussion of technology centers on the use of workstations in the classroom for demonstrations of musical ideas and subject matter. He briefly touches on software available for composition. The article was written in 1990, which would seem to make it out of date, but the author's discussion of technology is fairly surface level, showing how a MIDI workstation is set up. The basic set up of such a workstation has not changed significantly since the time of the article, making it of some use today.

Wei Li and **Xiangyang Xue.** "An Audio Watermarking Technique That Is Robust Against Random Cropping," *Computer Music Journal,* Vol. 27, No. 4. Cambridge, MA: MIT Press, (Winter, 2003): 58-68.

This is an article describing the use of audio watermarking. "Audio watermarking is a technique that embeds information with specific meaning into the host media without interference to the quality of the original work."

Wessel, David and **Matthew Wright.** "Problems and Prospects for Intimate Musical Control of Computers," *Computer Music Journal,* Vol. 26, No. 3. Cambridge, MA: MIT Press, (Fall, 2002): 11-22.

"When asked what musical instrument they play, few computer musicians respond spontaneously with 'I play the computer.' Why not?" In this article, the authors examine the prospect of the computer as a musical instrument.

Whiteley, Sheila. "Popular Music and Technology Conference," *Popular Music*, Vol. 17, No. 3. (Oct., 1998): 327-328. URL: http://links.jstor.org/sici?sici=0261-1430%28199810%2917%3A3%3C327%3APMATC%3E2.0.CO%3B2-G

This article is a short rehash of the conference held at the Department of Music of the University of Salford, England. The range of topics dealt with the effects of technology on the art of music.

Wright, Paul. "New Technology in the Classroom," *The Musical Times*, Vol. 133, No. 1794. (Aug., 1992): 379+381. URL: http://links.jstor.org/sici?sici=0027-4666%28199208%29133%3A1794%3C379%3ANTITCA%3E2.0.CO%3B2-U

Mr. Wright discusses the incorporation of new technology into a classroom setting. While technology has improved since the time of the article, the challenges of moving that technology into the teaching environment have remained the same. "Creative use of music technology in schools is still in its infancy. Human imagination is the only factor to limit its power to combine the new and the old in undreamt of worlds of sound and depths of expression."

Zicarelli, David. "How I Learned to Love a Program That Does Nothing," *Computer Music Journal,* Vol. 26, No. 4. Cambridge, MA: MIT Press, (Winter, 2002): 44-51.

The author explores the use of the program Max. [See above article, "Max at Seventeen"]

Websites

ATMI: The Association for Technology in Music Instruction. http://atmi.music.org/ Maintained by Bill Clemmons, Point Loma Nazarene Univ.

The ATMI site is designed for members of the organization. There is an automated mail service (Listserv) for correspondence among members. The organization is run by university personnel from around the country (their board of directors is listed on the home page.

Big Ears: The Original Online Ear Trainer. http://www.ossmann.com/bigears/. Michael Ossmann, 1997.

This site offers online interval training in one octave, ascending or descending.

Classical Net. http://www.classical.net/music/links/musiclib.html

The site is dedicated to classical music. The portion of the site listed here is its Classical Music Links/Music Schools, Libraries, Academic Links page.

Computer Music Magazine (Online Version). http://www.computermusic.co.uk/. Bath, England: Future Publishing.

This is the web site associated with the print magazine. Online there are tutorials, reviews, demos, a beginners guide, and a forum. It does not contain all of the information that is in the print version.

Computer Music Journal. http://mitpress2.mit.edu/e-journals/Computer-Music-Journal/. Cambridge, MA: MIT Press Journals.

The web site contains a complete list of past and present editions that include contents for each, with access to articles for subscribers. There are some free articles available for non-subscribers. In addition, there is an extensive bibliography listed by subject.

Center for New Music and Audio Technologies. http://cnmat.cnmat.berkeley.edu/. Berkeley, CA. Maintained by Eleanor Ronaele.

CNMAT is a music research, teaching, recording and performance facility located in the hills just north of the UC Berkeley campus. A satellite of the UC Berkeley Department of Music , CNMAT is an interdisciplinary research center, drawing participants from many university departments including physics, mathematics, electrical engineering, psychology, computer science, cognitive science and music. The site includes a list of staff and courses available through CNMAT. The web site also includes an extensive list of articles emanating from CNMAT and most are available online in .PDF format. There is a download page for accessing projects and programs.

Eastman Computer Music Center. http://www.esm.rochester.edu/. The Eastman Computer Music Center (ECMC) is part of the Eastman School of Music, a division of the University of Rochester. Maintained by Christopher D. Brakel.

In addition to information concerning the Computer Music Center at Eastman, the web site has a download page to obtain *Score 11* software for Linux enabled computers. There is also an extensive links page with Linux and Windows program web resources.

Good-Ear.com. http://www.good-ear.com. Martin Schoeberl, 2000.

A fairly comprehensive, on-line ear-training site. Training includes intervals, scales, chords, cadences, and pitch identification. Controls allow change of tempo, volume, and instrument.

Harmony-Central. http://www.harmony-central.com

Industry links, Forums, and Software Downloads.

HTML: An Interactive Tutorial for Beginners.
http://www.davesite.com/webstation/html/

This site contains an easy to follow, basic tutorial. At the end of each chapter, students can input their own HTML code and test the results from within the web browser.

HTML Goodies. http://www.htmlgoodies.com

This is a great tutorial site for learning web creation.

MENC (Music Educators National Conference). http://www.menc.org. Reston, VA: MENC. Maintained by Scott Krize and Scott Fergus.

MENC's web site contains a huge library of articles for music educators, including a section dedicated to music technology. The site also includes books, available in e-book format, for purchase and downloads. There is also a large selection of education-oriented links. "The mission of MENC: The National Association for Music Education is to advance music education by encouraging the study and making of music by all."

MIDI Web. http://www.midiweb.com

This is a good resource for information and links concerning MIDI.

MusicMoz. http://www.musicmoz.org

"MusicMoz is a comprehensive directory of all things music, edited by volunteers. We list, and accept submissions of, music-related reviews, articles, factual information, biographies, and websites."[11]

Music Technology Online Magazine.
http://www.lentine.com/articles/Article_front_page.htm. Akron, OH. Maintained by Lentine's Music.

This website contains a huge list of online articles in the following categories: Music Education Technology Articles, Instructional Courseware Articles, Scoring/Notation Software Articles, Sequencing Program Articles, MIDI Instruments, PA System Articles, Recording, Technology Labs, and Administrative and Drill Design. The magazine is run by Lentine's Music, a music retailer, so some of the articles may have a sales slant, but overall the articles are very informative. There are currently 144 articles listed on the site, a sampling of which can be found in the Web Articles section that follows.

SBO Magazine (School, Band and Orchestra). Needham, MA: Symphony Publishing. http://www.sbomagazine.com/technology.html. Maintained by Beth Atkinson.

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[11] From the MusicMoz Website. http://www.musicmoz.com.

This is the technology archive section of SBO magazine. The articles included run a month behind the print version of the magazine. The music technology articles are all written by Dr. John Kuzmich Jr.

Synth Zone. http://www.synthzone.com

"Synth Zone is an attempt to ease the search for synthesizer & electronic music production resources on the Internet."[12] This site contains a good selection of links.

The Technology Institute for Music Educators. http://www.ti-me.org/ Maintained by Steven Estrella.

This is the website for TI:ME (The Technology Institute for Music Educators). The site includes links to old newsletters, membership information, and information available only to member.

Web Monkey. http://www.webmonkey.com

This is a great web site with easy to follow tutorials on web page creation.

Web Articles

Bain, Dr. Reginald. "Innovative Software for the University-Level Music Theory Classroom," *Music Technology Online Magazine.* http://www.lentine.com/articles/innovative_software.htm

Dr. Bain takes a look at web based music instruction.[13]

Balzer, Dr. Sam. "Multimedia Listening Lessons," *Music Technology Online Magazine.* http://www.lentine.com/articles/Multimedia%20Listening%20Lessons.htm

Dr. Balzer talks about using CD-ROM based programs for music instruction. Dr. Balzer is the director of music education at Shorter College in Rome, GA.[14]

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[12] From the Synth Zone website. http://www.synthzone.com

[13] This website is run by Lentine's Music, an online retailer, and all articles include their sales contact information.

[14] Ibid.

Bates, Mike, et. al. "Opportunity-to-Learn Standards for Music Technology," Reston, VA: Music Educators National Conference web site, 1999. http://www.menc.org/publication/books/techstan.htm.

This article and accompanying list outline the standards for using and teaching technology in schools for grades pre-k-12. It is a good resource for evaluating the level of technology at any given school and offers both minimal and optimal layout for student access to technology.

Cark, Dr. Frank L. "You're On The Net - Now Get Plugged-In!" *Music Technology Online Magazine*. http://www.lentine.com/articles/net.htm

This article is a basic guide for using the web and plug-ins in the classroom.[15]

Hicks, Doug. "A Brief Finale Tutorial," *Music Technology Online Magazine*. http://www.lentine.com/articles/a_brief_finale_tutorial.htm[16]

Hicks, Doug. "Learning to Use Music Computer Software," *Music Technology Online Magazine*. http://www.lentine.com/articles/Learning%20to%20Use%20Music%20Computer%20Software.htm[17]

Kallestad, Leigh. "Incorporating Technology Into Traditional Teaching," *SBO Magazine*. Needham, MA: Symphony Publishing, November 2002. http://www.sbomagazine.com/sbomag/nov02/technology.html

A twenty-seven year veteran public school teacher, Mr. Kallestad discusses ways that technology can be incorporated into the classroom, from e-mail communications to electronic grading to theory and ear-training.

Kuzmich, John, Jr. "Acquiring and Updating Used Computers," *SBO Magazine*. Needham, MA: Symphony Publishing, March 1999. http://www.sbomagazine.com/sbomag/mar99/technology.html

Given that the practice of donating used computers to schools is very prominent, this is a great article that teaches the music educator the basics of how to upgrade and incorporate these machines into the classroom.

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[15] This website is run by Lentine's Music, an online retailer, and all articles include their sales contact information.
[16] Ibid.
[17] Ibid.

Kuzmich, John, Jr. "Automatic Accompaniment Generators," *SBO Magazine.* Needham, MA: Symphony Publishing, September 2004. http://www.sbomagazine.com/sbomag/sep04/technology.html

The author reviews three programs designed to create music accompaniment, Band-in-a Box, Smartmusic, and iPAS.

Kuzmich, John, Jr. "Band Methods and Software: Interactive Practice at Home," *SBO Magazine.* Needham, MA: Symphony Publishing, October 2001. http://www.sbomagazine.com/sbomag/oct01/technology.html

Mr. Kuzmich outlines the software available for teaching band methods.

Kuzmich, John, Jr. "Building Exciting Web Pages: Part II," *SBO Magazine.* Needham, MA: Symphony Publishing, June 2000. http://www.sbomagazine.com/sbomag/jun00/technology.html

This is part two of a basic guide to creating a band web site.

Kuzmich, John, Jr. "Building Your Own Web Page," *SBO Magazine.* Needham, MA: Symphony Publishing, January 2000. http://www.sbomagazine.com/sbomag/jan00/technology.html

This is the first installment of a two-part article [see above] designed to teach the basics of creating a band web site.

Kuzmich, John, Jr. "Computer Music Lab 101," *SBO Magazine.* Needham, MA: Symphony Publishing, September 2000. http://www.sbomagazine.com/sbomag/sep00/technology.html

The author outlines the steps necessary to create a computer music lab for a school.

Kuzmich, John, Jr. "Digital Audio Recording Technology: The Sequencing Market," *SBO Magazine.* Needham, MA: Symphony Publishing, October 2002. http://www.sbomagazine.com/sbomag/oct02/technology.html

This is an article, the second in a two part series, that gives an overview of the many pieces of sequencing software available to the computer musician.

Kuzmich, John, Jr. "Dream and Plan into the 21st Century: Computer Music Lab Brain Storming," *Music Technology Online Magazine.* http://www.lentine.com/articles/Dream_Kuzmich.htm

This is a good article discussing how to begin to incorporate music technology into a classroom. There are links software company websites as they are discussed. [18]

Kuzmich, John, Jr. "Field Show Design: Drill Design Options," *SBO Magazine.* Needham, MA: Symphony Publishing, May 2002.
http://www.sbomagazine.com/sbomag/may02/technology.html

While his other software articles have given the reader a view of many programs available for sequencing and notation, this article discusses only one piece of software, Pyware. Pyware is the only program on the market designed to assist music educators in field show design.

Kuzmich, John, Jr. "Getting Started with MIDI," *SBO Magazine.* Needham, MA: Symphony Publishing, June 2001.
http://www.sbomagazine.com/sbomag/jun01/technology.html

This article is a good beginners guide to MIDI.

Kuzmich, John, Jr. "Internet Licensing: Getting Music Copyright Laws Right," *SBO Magazine.* Needham, MA: Symphony Publishing, November 2003.
http://www.sbomagazine.com/sbomag/nov03/technology.html

Kuzmich, John, Jr. "Jazz Applications: Enhancing Jazz Education with Technology," *SBO Magazine.* Needham, MA: Symphony Publishing, March 2002.
http://www.sbomagazine.com/sbomag/mar02/technology.html

Mr. Kuzmich discusses both software and Internet applications designed to aid educators in teaching jazz.

Kuzmich, John, Jr. "Learning Strategies: Technology Literacy for Teachers," *SBO Magazine.* Needham, MA: Symphony Publishing, April 2002.
http://www.sbomagazine.com/sbomag/apr02/technology.html

This is an a great article that shows the reader the many options available for learning current computer and music technology outside of a college setting.

Kuzmich, John, Jr. "Making School Web Pages More User-Friendly," *SBO Magazine.* Needham, MA: Symphony Publishing, September 2001.
http://www.sbomagazine.com/sbomag/sep01/technology.html

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[18] This website is run by Lentine's Music, an online retailer, and all articles include their sales contact information.

This article shows way to improve band web pages by including fundraising, calendars, music practice, newsletters, electronic grade books, automatic accompaniment generators, audio and video clips/streaming, and music scores.

Kuzmich, John, Jr. "Marching Band Show Designer Software," *SBO Magazine.* Needham, MA: Symphony Publishing, May 2000. http://www.sbomagazine.com/sbomag/may00/technology.html

The author examines Pygraphics and Drill Quest software.

Kuzmich, John, Jr. "Music Education Computer Games," *SBO Magazine.* Needham, MA: Symphony Publishing, March 2000. http://www.sbomagazine.com/sbomag/mar00/technology.html

Mr. Kuzmich examines some of the many software games available to assist in teaching music to children.

Kuzmich, John, Jr. "Music Lessons Through the Computer," *SBO Magazine.* Needham, MA: Symphony Publishing, January 2001. http://www.sbomagazine.com/sbomag/jan01/technology.html

The author describes the many software titles available to assist in teaching various band instruments as well as some theory training software.

Kuzmich, John, Jr. "Music Office Software: Getting Organized," *SBO Magazine.* Needham, MA: Symphony Publishing, May 2001. http://www.sbomagazine.com/sbomag/may01/technology.html

Mr. Kuzmich reviews the different options available to band directors for organizing their office using various pieces of software, including: Pyware Music Office and Music Administrator System, WinBand and WinChoir, The RCI Music Library, Music Manager Software, and Lotus Organizer.

Kuzmich, John, Jr. "Music Reading Software: Tomorrow's Applications Today," *SBO Magazine.* Needham, MA: Symphony Publishing, November 2000. http://www.sbomagazine.com/sbomag/nov00/technology.html

This article describes the use of scanning software to help speed the process of entering music into a computer.

Kuzmich, John, Jr. "Music Tech Labs on a Small Budget," *SBO Magazine.* Needham, MA: Symphony Publishing, September 2003. http://www.sbomagazine.com/sbomag/sep03/technology.html

Mr. Kuzmich gives a well thought out overview of what is necessary to create a new music lab given limited funding.

Kuzmich, John, Jr. "Music Technology Labs: Getting Their Classes Wired," *SBO Magazine*. Needham, MA: Symphony Publishing, April 2003. http://www.sbomagazine.com/sbomag/apr03/technology.html

The author sent out a questionnaire to thirteen music educators asking questions about music tech labs. The article is a conglomeration of their responses.

Kuzmich, John, Jr. "Music Theory for All Students," *SBO Magazine*. Needham, MA: Symphony Publishing, April 2001. http://www.sbomagazine.com/sbomag/apr01/technology.html

This article outlines the huge number of software titles available to assist in music theory training.

Kuzmich, John, Jr. "Notation Software on a Budget," *SBO Magazine*. Needham, MA: Symphony Publishing, April 2004. http://www.sbomagazine.com/sbomag/apr04/technology.html

With a wide range of notation software available on the market, the author briefly describes a number of notation programs and includes a product comparison chart.

Kuzmich, John, Jr. "Orchestra Applications: The World of String Technology," *SBO Magazine*. Needham, MA: Symphony Publishing, January 2002. http://www.sbomagazine.com/sbomag/jan02/technology.html

This article has a section describing Virtual Virtuoso, a program designed to aid string players in their practice.

Kuzmich, John, Jr. "Percussion Technology: Part I," *SBO Magazine*. Needham, MA: Symphony Publishing, November 2001. http://www.sbomagazine.com/sbomag/nov01/technology.html

The first installment of a two-part article, this section discusses tutorial technology available to the percussionist as well as notation software for percussion parts.

Kuzmich, John, Jr. "Percussion Technology: Part II," *SBO Magazine*. Needham, MA: Symphony Publishing, December 2001. http://www.sbomagazine.com/sbomag/dec01/technology.html

This is the second half of a two-part article, which discusses drum machines and software available for sequencing drum parts.

Kuzmich, John, Jr. "Remote Wed Design: Traveling Web Sites," *SBO Magazine.* Needham, MA: Symphony Publishing, June 2002.
http://www.sbomagazine.com/sbomag/jun02/technology.html

In his ongoing series on web design for music educators, Mr. Kuzmich shows how adding updates during a tour can enhance a band web site.

Kuzmich, John, Jr. "Sequencing/Digital: Creative Recording Techniques," *SBO Magazine.* Needham, MA: Symphony Publishing, September 2002.
http://www.sbomagazine.com/sbomag/sep02/technology.html

The first in a two part series, this article gives the reader the basic techniques of recording using sequencing software.

Kuzmich, John, Jr. "Software Applications that Work," *SBO Magazine.* Needham, MA: Symphony Publishing, April 1999.
http://www.sbomagazine.com/sbomag/apr99/technology.html

This is the first article on this web site and it outlines the basic software available to the music educator.

Kuzmich, John, Jr. "Software Tutorials: Computerized Guitar and Bass Instruction," *SBO Magazine.* Needham, MA: Symphony Publishing, January 2003.
http://www.sbomagazine.com/sbomag/jan03/technology.html

Mr. Kuzmich examines the CAI (computer aided instruction) programs designed to teach guitar and bass guitar.

Kuzmich, John, Jr. "The Creative Aspects of Video Streaming," *SBO Magazine.* Needham, MA: Symphony Publishing, December 2000.
http://www.sbomagazine.com/sbomag/dec00/technology.html

This article outlines the advantages of using streaming video in a school band web site.

Kuzmich, John, Jr. "Transcribing at the Speed of Your Computer," *SBO Magazine.* Needham, MA: Symphony Publishing, March 2001.
http://www.sbomagazine.com/sbomag/mar01/technology.html

The author describes three software titles available to assist in transcribing music:

Transkriber, Transcribe!, and Slow Gold.

Kuzmich, John, Jr. "Web Development Series: Guide to Graphic Editor Software Applications," *SBO Magazine*. Needham, MA: Symphony Publishing, July 2003. http://www.sbomagazine.com/sbomag/jul03/technology.html

This is the sixth installment of an ongoing series of article designed to teach web design to music educators.

Kuzmich, John, Jr. "What to do with Older, Donated Computers," *Music Technology Online Magazine*. http://www.lentine.com/articles/Older_Computers.htm

Given that teachers are not always provided with the latest in computer technology, this article explores the software options for older, out of date computers.[19]

Kuzmich, John, Jr. "Why is MP3 So Important for Music Educators," *SBO Magazine*. Needham, MA: Symphony Publishing, October 2000. http://www.sbomagazine.com/sbomag/oct00/technology.html

This is an article early in the age of MP3 describing its importance to music education.

Langol, Stefani. "In the spotlight: An interview with Bob Moog," *Music Technology Online Magazine*. http://www.lentine.com/articles/In%20the%20spotlight%20An%20interview%20with%20Bob%20Moog.htm

This is an interview with one of the pioneers of synthesizer technology, Bob Moog.[20]

Leiner, Barry M., et al. "A Brief History of the Internet," Internet Society webpage (2003). http://www.isoc.org/internet/history/brief.shtml

Long, Rick. "Basic MIDI Connections," *Music Technology Online Magazine*. http://www.lentine.com/articles/Rick_Long_Basic_Midi_2001_2002.htm

Mr. Long describes the basics of MIDI setups.[21]

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[19] This website is run by Lentine's Music, an online retailer, and all articles include their sales contact information.

[20] Ibid.

[21] Ibid.

Long, Rick. "Developing Creativity: Loop Based Music on Your Computer," *Music Technology Online Magazine,* [2002], pp. 42-43.
http://www.lentine.com/articles/Article_front_page.htm

This article is a software review of music looping software. The software titles reviewed are Acid, Super Duper Music Looper, and Cakewalk: Home Edition.[22]

Melton, Bill. "How To Start and Build Your Computer Lab," *Music Technology Online Magazine.*
http://www.lentine.com/articles/How%20To%20Start%20and%20Build%20Your%20Computer%20Lab.htm[23]

Muro, Don. "A Closer Look at Dynamics in MIDI Sequencing," *Music Technology Online Magazine.*
http://www.lentine.com/articles/Dynamics_midiseq_Muro_2001_2002.htm[24]

Muro, Don. "How to Make Cassette Copies of Your Sequence," *Music Technology Online Magazine.*
http://www.lentine.com/articles/How%20to%20make%20cassette%20copies%20of%20your%20sequence.htm[25]

Muro, Don. "Practical Recording Techniques for MIDI Sequencing," *Music Technology Online Magazine,* 2002, pp. 34-35. http://www.lentine.com/articles/muro_2002.pdf

This article is a basic tutorial on how to use sequencing software.[26]

Muro, Don. "Two Sequencing Tips," *Music Technology Online Magazine.*
http://www.lentine.com/articles/Two%20Sequencing%20Tips.htm

Mr. Muro gives tips on changing meter during a sequencing track and how to add variety to drum tracks.[27]

Muro, Don. "Technology: A Tool For Music Education," *Music Technology Online Magazine.*

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[22] This website is run by Lentine's Music, an online retailer, and all articles include their sales contact information.
[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] Ibid.
[27] Ibid.

http://www.lentine.com/articles/Technology,%20A%20Tool%20For%20Music%20Education.htm[28]

Peters, G. David. "Music/Computer Labs: Arranging Teaching and Learning Space for Success," *Music Technology Online Magazine,* 2000.
http://www.lentine.com/articles/space_for_success.htm

Mr. Peters article talks about the design of a computer/music workspace and uses illustrations to demonstrate advantages and disadvantages of different layouts.[29]

Peters, G. David. "Music Software, Networks, Labs and Licenses," *Music Technology Online Magazine*. http://www.lentine.com/articles/music_software_networks.htm

This article takes a look at an important aspect of music in schools, the need for site licenses to keep a lab legally set up. G. David Peters is the Director of the School of Music at Indiana University.[30]

Peters, G. David. "Music Software to Support the Music Curriculum," *Music Technology Online Magazine*.
http://www.lentine.com/articles/music_software_to_support_the_mu.htm

This article describes the incorporation of music software into an existing music program. G. David Peters is the Director of the School of Music at Indiana University.[31]

Peters, G. David. "Music Technology: From Trends to Standards," *Music Technology Online Magazine,* 2002, pp. 14-15.
http://www.lentine.com/articles/Article_front_page.htm

G. David Peters is the Director of the School of Music at Indiana University. His article discusses the change from a trend to a standard in music software, including what those trends and standards are for notation, sequencing, and education software.[32]

Peters, G. David. "Software Instruction: Year 2000," *Music Technology Online Magazine.*
http://www.lentine.com/articles/Software%20Instruction,%20Year%202000.htm

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[28] This website is run by Lentine's Music, an online retailer, and all articles include their sales contact information.
[29] Ibid.
[30] Ibid.
[31] Ibid.
[32] Ibid.

Making choices in software can be difficult at best and most of the time looking at reviews is not helpful, given writers bias. This article discusses those difficulties and gives a brief look at the software available for different areas of music instruction. G. David Peters is the Director of the School of Music at Indiana University.[33]

Pickard, Beth. "Maximizing The One-Computer Music Classroom," *Music Technology Online Magazine,* http://www.lentine.com/articles/Beth_Pickard.htm

This is a short article written by an instructor from Indiana University School of Music at Indianapolis. Dr. Frank L. Cark is an Associate Professor of Music at the University of South Alabama.[34]

Pinchock, George. "It's about TI:ME," *Music Technology Online Magazine.* http://www.lentine.com/articles/It%92s%20about%20TIME.htm

This is a description of The Technology Institute for Music Educators.[35]

Reid, Gordon. "The History of Roland: Part 3 1986-1991," *Sound on Sound: The World's Best Music Recording Magazine,* January (2005). http://www.soundonsound.com/sos/jan05/articles/roland.htm.

Reuter, Dr. Rocky J. "MIDI Basics for Music Educators: Let's Not Make This Difficult!" *Music Technology Online Magazine.* http://www.lentine.com/articles/Mbasics.htm8

This is a simple guide to MIDI.[36]

Reuter, Dr. Rocky J. "The MIDI Ensemble," *Music Technology Online Magazine.* http://www.lentine.com/articles/The%20MIDI%20Ensemble.htm

Dr. Reuter discusses the creation of a MIDI ensemble at the Capital University Conservatory of Music.[37]

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[33] This website is run by Lentine's Music, an online retailer, and all articles include their sales contact information.
[34] Ibid.
[35] Ibid.
[36] Ibid.
[37] Ibid.

Roland Corp., USA. "Thinking Outside the Box: Reaching Beyond the Bandroom," *Music Technology Online Magazine.*
http://www.lentine.com/articles/beyond_the_bandroom.htm

This article describes the ways that technology based instruments can be incorporated into the teaching environment. It includes links to sources of funding to assist schools in acquiring new technology.[38]

Rudolph, Dr. Thomas E. "25 Ways To Use The MIDI Sequencer In The Music Classroom & Rehearsal," *Music Technology Online Magazine.*
http://www.lentine.com/articles/25_ways.htm[39]

Rudolph, Dr. Thomas E. "Curriculum Materials for the Secondary Electronic Keyboard Lab," *Music Technology Online Magazine.*
http://www.lentine.com/articles/Curriculum%20Materials%20for%20the%20Secondary%20Electronic%20Keyboard%20Lab.htm

Dr. Rudolph outlines the creation of a curriculum for a school.[40]

Rudolph, Dr. Thomas E. "Music Education Software Recommendations," *Music Technology Online Magazine.*
http://www.lentine.com/articles/Music%20Education%20Software%20Recommendations.htm[41]

Rudolph, Dr. Thomas E. "Notation Software: The Ultimate Tool for the Music Teacher," *Music Technology Online Magazine.*
http://www.lentine.com/articles/notation_software.htm[42]

Siegel, Jack. "How One Class with One Computer Composed Music," *Teaching Music*, April 2004: pp. 44-48.
http://www.menc.org/publication/articles/academic/genmusarticle/howoneclass.html.

The article outlines the process of teaching a class composition using computers with extremely limited resources. Using only one computer, the author had his third, fourth, and fifth grade general music class creates a composition. Starting with individual poems, the class voted on the poem they liked best and worked as a group to refine the work, then set about setting it to music using only a laptop,

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[38] This website is run by Lentine's Music, an online retailer, and all articles include their sales contact information.
[39] Ibid.
[40] Ibid.
[41] Ibid.
[42] Ibid.

an electronic keyboard, and a television (to give the entire group a view of the computer screen). A great lesson in making the best out of limited resources.

Smith, Doug. "Why do I need all this stuff?" *Music Technology Online Magazine.* http://www.lentine.com/articles/Why%20do%20I%20need%20all%20this%20stuff.htm

The author talks about resistance to technology and the lack of experience with music technology among some teachers.[43]

Smith, Greg. "How To Select Instructional Software Based on Your Needs," *Music Technology Online Magazine.* http://www.lentine.com/articles/How%20to%20select.htm

Mr. Smith outlines the process necessary for determining the software needs of a classroom.[44]

Smith, Greg. "Selecting the Right MIDI Instrument for Your Lab," *Music Technology Online Magazine.* http://www.lentine.com/articles/correct_MIDI_instrument.htm

This article outlines the attributes of MIDI instruments as an aid in deciding what would best fit a school music lab.[45]

Watson, Dr. Scott. "Making Waves With Your Music Students!" *Music Technology Online Magazine.* http://www.lentine.com/articles/Making_Waves.htm

This is a short article on incorporating sequencing software into teaching youngsters.[46]

Whitaker, Bob. "Copley Middle School Digital Piano Lab: 2001 Goal II," *Music Technology Online Magazine.* http://www.lentine.com/articles/Copley_MS.htm

Mr. Whitaker, the Assistant Principal at Copley Middle School, describes some of the steps taken to create a new piano lab.[47]

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[43] This website is run by Lentine's Music, an online retailer, and all articles include their sales contact information.
[44] Ibid.
[45] Ibid.
[46] Ibid.
[47] Ibid.

Thesis and Dissertations

Byrd, Donald Alvin. "Music Notation by Computer," Ph.D., Indiana University, 1984. [i], v-xvi, [i], 205, [34] pp., 137-item bibliography, appendices.

> A dissertation concerned with the problems and solutions for creating conventional music notation with a computer, something that was not a simple task in 1984.

David Trustman
<donnercruz@mac.com>
04/18/2006 09:40 AM

To rhea.williamson@sjsu.edu
cc
bcc
Subject Fwd: Copyright for Amarilli, mia bella

Dr. Williamson,

The music I was waiting for copyright approval is public domain. Here is the email from Schirmer Inc.

Could you please attach this to the stack of copyright approvals for my thesis or forward it to the reader.

Thank you,

David Trustman

Begin forwarded message:

> From: "Garcia. Cole, Aida" <aida.garcia-cole@musicsales.com>
> Date: April 18, 2006 8:29:51 AM PDT
> To: 'David Trustman' <donnercruz@mac.com>
> Subject: RE: Copyright for Amarilli, mia bella
>
> Dear Mr. Trustman,
>
> Please be advised that "Amarilli, mia bella" from Schirmer's
> "Twenty-Four Italian Songs and Arias," Vol. 1723 is in the public
> domain. You do not need to obtain permission to include this work
> in your thesis/dissertation.
>
> Best of luck with your project!
>
> Best regards,
> --
> Aida Garcia-Cole
> Print Licensing Manager
> Music Sales Corporation
> & G. Schirmer, Inc.
> 257 Park Avenue South, 20th Fl
> New York, NY 10010
> Phone: (212) 254-2100 ext 120
> Fax: (212) 254-2013
> Email: aida.garcia-cole@musicsales.com
> www.musicsales.com
> The Music Sales Group
> New York * Los Angeles * London * Berlin * Copenhagen * Madrid *
> Paris *
> Sydney * Tokyo
>
>
> -----Original Message-----
> From: David Trustman [mailto:donnercruz@mac.com]
> Sent: Tuesday, April 18, 2006 11:18 AM
> To: agc@musicsales.com
> Subject: Copyright for Amarilli, mia bella
>

> Ms. Garcia-Cole,
>
> As per our conversation, I am doing a master's thesis and quoting
> "Amarilli, mia bella" from Schirmer's "Twenty-Four Italian Songs and
> Arias," Vol. 1723.
>
> I would like your approval to use the above listed music.
>
> Thank you,
>
> David Trustman
>

Edison Phonograph

From: "Dwayne Wyatt" <oldcrank@pacific.net>
Subject: **Re: Phonograph Photo's**
Date: April 10, 2006 3:43:49 PM PDT
To: "David Trustman" <david@donnercruz.com>

Hi David,
I'm Flattered you find my photograph useful to you. Yes you have my permission to use this photograph for your studies, not for commercial purposes. If I can help further let me know.
Thank you,

Dwayne Wyatt
http://www.wyattsmusical.com

From: David Trustman

> **To:** oldcrank@pacific.net
> **Sent:** Monday, April 10, 2006 9:41 AM
> **Subject:** Phonograph Photo's
>
> As per our conversation this morning, I am writing a thesis on music technology for my graduate degree at San Jose State University and am including a Edison Phonograph picture from your website in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

Roland

From: jyamato@rolandus.com
Subject: **Use of Roland Product Photos for College Thesis**
Date: April 10, 2006 1:29:07 PM PDT
To: david@donnercruz.com
Cc: mmalbon@rolandus.com, BenP@rolandus.com, jvsauers@rolandus.com, fumiew@rolandus.com

To: Mr. David Trustman
San Jose State University

Dear Mr. Trustman:

Per your request, I am writing to follow up on our telephone call this morning concerning your desire to use certain Roland product photos.

As we discussed, Roland US will grant you a one-time license to use photos of the Roland V-Drums and the Roland V-Accordion from Roland US's website at www.rolandus.com for your college thesis concerning music technology which you shall submit to San Jose State University. Please note that you may not denigrate or criticize Roland products in any way in connection with your use of the Roland product photos.

If you prefer, I attach a web link which contains high-resolution images of these Roland product photos which you may use for this purpose. http://www.rolandus.com/media

I hope this information is helpful for you. Thank you for your interest in Roland products. Please call me if have any additional questions.

Very truly yours,

Jun Yamato
General Counsel
Roland Corporation U.S.

Switched on Sound

From: brian cooper <bcooper@tip.duke.edu>
Subject: **Duke TIP's Switched on Sound**
Date: April 11, 2006 7:00:14 AM PDT
To: david@donnercruz.com

David,

Please consider this e-mail as written permission from the Duke University Talent Identification Program to use screen shots from Duke TIP's *Switched on Sound* CD-ROMs in your thesis, provided that the use of those screenshots is not in a context that reflects negatively on Duke University, Duke University TIP, or Duke TIP's *Switched on Sound*.

Should you have any other questions, please feel free to contact me.

All the best,

Brian Cooper
Director of Educational Resources
Duke University Talent Identification Program
1121 West Main Street
Durham, NC 27701
(919) 668-9122 / (Fax) (919) 668-9141
bcooper@tip.duke.edu
http://www.tip.duke.edu

Theremin

From: John Pascuzzi <johnp@oddmusic.com>
Subject: **Re: Copyright**
Date: April 5, 2006 9:09:06 AM PDT
To: David Trustman <david@donnercruz.com>

Hi David,

I've never been able to find copyright information for any of those photos, so I'm pretty sure they are public domain.

-- John

At 06:07 PM 4/4/06, you wrote:

> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including Theremin pictures from your website in the thesis. Are they copyrighted? If so, who holds the copyright.
>
> Thank you,
>
> David Trustman

Ray Kurzweil

From: Ray Kurzweil <ray@kurzweiltech.com>
Subject: **RE: Copyright**
Date: April 9, 2006 11:15:25 AM PDT
To: 'David Trustman' <donnercruz@mac.com>
Cc: Emily Brown <emily@kurzweiltech.com>, Neil Reynolds <nreynolds@kurzweiltech.com>

David. You have my permission to use this picture. Best of luck with your thesis. Best. Ray Kurzweil

---

From: David Trustman [mailto:donnercruz@mac.com]
Sent: Sunday, April 09, 2006 2:07 PM
To: technology@kurzweiltech.com
Subject: Copyright

I am writing a thesis on music technology for my graduate degree at San Jose State University and am including a picture of Ray Kurzweil and Stevie Wonder (http://www.kurzweiltech.com/kms.html) from your website in the thesis. I would like your permission to do so.

Thank you,

David Trustman

Rhythmate

From: matrix <matrix6@matrixsynth.com>
Subject: **Re: Copyright**
Date: April 4, 2006 8:57:35 PM PDT
To: David Trustman <donnercruz@mac.com>

Feel free to use those. They were pulled off of an Ebay auction.

Cheers,
-matrix
http://matrixsynth.blogspot.com

----- Original Message -----
From: David Trustman
To: matrix
Sent: Tuesday, April 04, 2006 8:26 PM
Subject: Re: Copyright

http://matrixsynth.blogspot.com/2005/12/chamberlin-rhythmate-tape-loop-drum.html

Thanks,

David

On Apr 4, 2006, at 8:04 PM, matrix wrote:

> Can you send me a link to the post? Some of the pictures I've put up may need to be cleared by others.
>
> Cheers,
> -matrix
> http://matrixsynth.blogspot.com
>
> ---
>
> ----- Original Message -----
> **From:** David Trustman
> **To:** matrix6@matrixsynth.com
> **Sent:** Tuesday, April 04, 2006 7:07 PM
> **Subject:** Copyright
>
> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including a Rhythmate picture from your website in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

Tape Loop Pictures

From: Ingvar Loco Nordin <loco.nordin@mbox200.swipnet.se>
Subject: **Ok**
Date: April 4, 2006 11:04:12 PM PDT
To: <david@donnercruz.com>

OK!

Ingvar Loco Nordin

> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including some pictures of tape looping from your website in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

****
All places are here! All times are now!
****

Homepage: http://www.sonoloco.allt.nu
which is a shortcut to
(http://home.swipnet.se/sonoloco)

Sonoloco Record Reviews: http://www.sonoloco.just.nu
which is a shortcut to
(http://home.swipnet.se/sonoloco2/Rec/reviewframes.html)

NEWS at Sonoloco Record Reviews:
http://home.swipnet.se/sonoloco12/news/newsframes.html

Ingvar Loco Nordin
Diagonalvagen 36
611 57 Nykoping
Sweden

Telephone +46 (0)155 288991

Synthaxe

From: Phi <Phi@open-tuning.com>
Subject: **Re: Copyright**
Date: April 4, 2006 10:20:33 PM PDT
To: David Trustman <david@donnercruz.com>

Hi David,

"I am writing a thesis on music technology for my graduate degree at San Jose State University and am including a Synthaxe picture from your website in the thesis. I would like your permission to do so."

Yes, you have my permission.
Thanks for emailing about this, and best of luck!

Kind regards,
Phil

Simmons SD5

From: paul.maddox@synth.net
Subject: **Re: Copyright**
Date: April 4, 2006 10:51:22 PM PDT
To: David Trustman <donnercruz@mac.com>

Hi,

> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including a Simmons SD5 picture from your website (http://www.simmons.synth.net/sds5/) in the thesis. I would like your permission to do so.

Certainly, the first 4 images are scans of the original adverts/leaflets, the others are from a list member who gave me permission to do with them as I please.

Best of luck with your thesis.

Paul

Synclavier

From: Synclavier <synclavier@500sound.com>
Subject: **Re: Copyright**
Date: April 5, 2006 5:10:12 AM PDT
To: David Trustman <david@donnercruz.com>

Yes, feel free to use this image in your thesis. Good luck with it, and we appreciate your asking permission.

Regards
The Synclavier team.

On 5 Apr 2006, at 13:06, David Trustman wrote:

> Sorry for the omission.
>
> It is the center picture on the web site.
>
> http://www.500sound.com/buttlogo/sync9600ts.jpg
>
> Thank you,
>
> David Trustman
> On Apr 5, 2006, at 12:28 AM, Synclavier wrote:
>
> > You have not included any information as to which picture you were intending to use..
> >
> > Regards
> > David Woods
> >
> > On 5 Apr 2006, at 02:55, David Trustman wrote:
> >
> > > I am writing a thesis on music technology for my graduate degree at San Jose State University and am including a Synclavier picture from your website in the thesis. I would like your permission to do so.
> > >
> > > Thank you,
> > >
> > > David Trustman

Syndrum

From: Audio Playground <audioplay@earthlink.net>
Subject: **Re: Copyright**
Date: April 5, 2006 6:37:32 AM PDT
To: David Trustman <donnercruz@mac.com>

on 4/4/06 9:11 PM, David Trustman at donnercruz@mac.com wrote:

> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including a Syndrum picture from your website in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

No worries, go ahead. thanks for asking.

--
Joseph Rivers

JR's Audio Playground
699 Clay St.
Winter Park, Fl. 32789

407-628-2119

audioplay@earthlink.net

Zeta Violin

From: "zeta music" <webmaster@zetamusic.com>
Subject: **RE: Customer Service Center**
Date: April 5, 2006 8:22:28 AM PDT
To: "'David Trustman'" <david@donnercruz.com>
Reply-To: <webmaster@zetamusic.com>

Hi,

It is OK to use the picture of the Jazz Fusion from the website.

Thank You,
Zeta Customer Service
1-480-557-5003
1-480-557-5007 fax

-----Original Message-----
From: David Trustman [mailto:david@donnercruz.com]
Sent: Tuesday, April 04, 2006 4:22 PM
To: Webmaster@ZetaMusic.com
Subject: Customer Service Center

Dear David Trustman,

Your question: 'I am writing a thesis on music technology for my graduate degree at San Jose State University and am including a Zeta Jazz Fusion picture from your website in the thesis. I would like your permission to do so.

Thank you,

David Trustman

'

Thank you for your questions.

david@donnercruz.com
David Trustman
890 Calabasas Rd
Watsonville, CA 95076

831-662-3040

Model of ZETA Instrument:

Serial No. of ZETA Instrument:

Date purchased, MM/DD/YY:

Dealer purchased at:

New field valuue:

Fairlight

From: Greg Holmes <gregh@ghservices.com>
Subject: **Re: Copyright**
Date: April 5, 2006 8:20:35 AM PDT
To: David Trustman <david@donnercruz.com>
Reply-To: Greg Holmes <gregh@ghservices.com>

David,

Yes, go ahead and use that image. I asked because I thought that I might have a higher-resolution version, but it would seem that those versions are on another computer. Oh well.

> It is:
> fairlight_cmi_ii_2.jpg

--
Greg Holmes
mailto:gregh@ghservices.com
GH Services, Ontario, Canada
Custom Software, Development, Training, and Selected Products
http://www.ghservices.com/
http://www.gregholmes.com/

Drumitar

From: Flecktones@aol.com
Subject: **reply**
Date: April 6, 2006 11:52:59 AM PDT
To: david@donnercruz.com

David this is Futureman and you have my permission to use the picture -When you get the chance please send me a copy of your thesis and the finished product
to
3415 Benham Ave Apt B
Nashville, Tennessee
37215
...I would love to read it and have a copy for myself...also go to starchronicles.com to see information about the Golden key --an animation project almost finished after two years ---I think you will find it interesting...there is also a drumitar picture of me on myspace.com/futuremanmusic ---and tni.com/futureman

take care and good luck with your work...Royel Futureman Wooten

Stockhausen

Dear David Trustman,

thank you for the information.

The original drawing of this first part of STUDIE I is a large paper roll. The original is on very dark brown paper.
I can send you the jpeg in colour, but first send you the black-white jpeg of the same drawing. The quality is also not very brilliant as the lines are very thin and not always very straight. But it is in any case better then the one published in the internet...

I send 2 different e-mails, I hope you can receive the rather large files:

Mit herzlichem Gruß

Kathinka Pasveer
fuer den Stockhausen-Verlag
Kettenberg 15
51515 Kuerten
Germany
Fax 02268-1813
www.stockhausen.org

Am 8. Apr 2006 um 20:39 schrieb David Trustman:
Dear Kathinka Pasveer,

My address is :

David Trustman
890 Calabasas Rd
Watsonville, CA 95076

The title of my thesis is "The World of Music Technology."

I would be happy to send a copy of the thesis, once it is completed.

It would be great to use a JPEG that you supply.

If there is anything further you need, please let me know.

Thank you,

David Trustman

On Apr 8, 2006, at 11:15 AM, Kathinka Pasveer wrote:
Dear David Trustman,

thank you for your message.

We first tried to trace down the website you gave us with the miserable and illegal illustration of STUDIE I (a photocopy of the pages from TEXTE zur MUSIK). They have not answered yet.

Please send us your complete address as well as the full title of your thesis.

The reproduction rights we could give you for one time use and we ask for one complimentary copy of your thesis for our archive.

The copyright should be mentioned as follows: © Karlheinz Stockhausen (www.stockhausen.org)

If you send me your agreement, I can then send you a jpeg file of the beginning of STUDIE I score

Mit herzlichem Gruß

Kathinka Pasveer
fuer den Stockhausen-Verlag
Kettenberg 15
51515 Kuerten
Germany
Fax 02268-1813
www.stockhausen.org

Am 8. Apr 2006 um 19:06 schrieb David Trustman:
I sent an email on April 4th stating my need for copyright use approval:

I am writing a thesis on music technology for my graduate degree at San Jose State University and am including an image from Studie I found on the following website:

http://www.medienkunstnetz.de/kuenstler/stockhausen/biografie/

I would like your permission to do so.

I need the approval for use of the image by Friday, April 14th. I hope that you can accommodate my request by that time and understand your office may be to busy to handle the request in such a short time. If I do not receive the approval in time, I will remove the image from the thesis before submitting it to the university.

Thank you for your time,

David Trustman

From: Kathinka Pasveer <Kathinka.St@t-online.de>
Subject: **Re: Copyright**
Date: April 8, 2006 11:15:53 AM PDT
To: David Trustman <donnercruz@mac.com>

Dear David Trustman,

thank you for your message.

We first tried to trace down the website you gave us with the miserable and illegal illustration of STUDIE I (a photocopy of the pages from TEXTE zur MUSIK). They have not answered yet.

Please send us your complete address as well as the full title of your thesis.

The reproduction rights we could give you for one time use and we ask for
one complimentary copy of your thesis for our archive.

The copyright should be mentioned as follows: © Karlheinz Stockhausen (www.stockhausen.org)

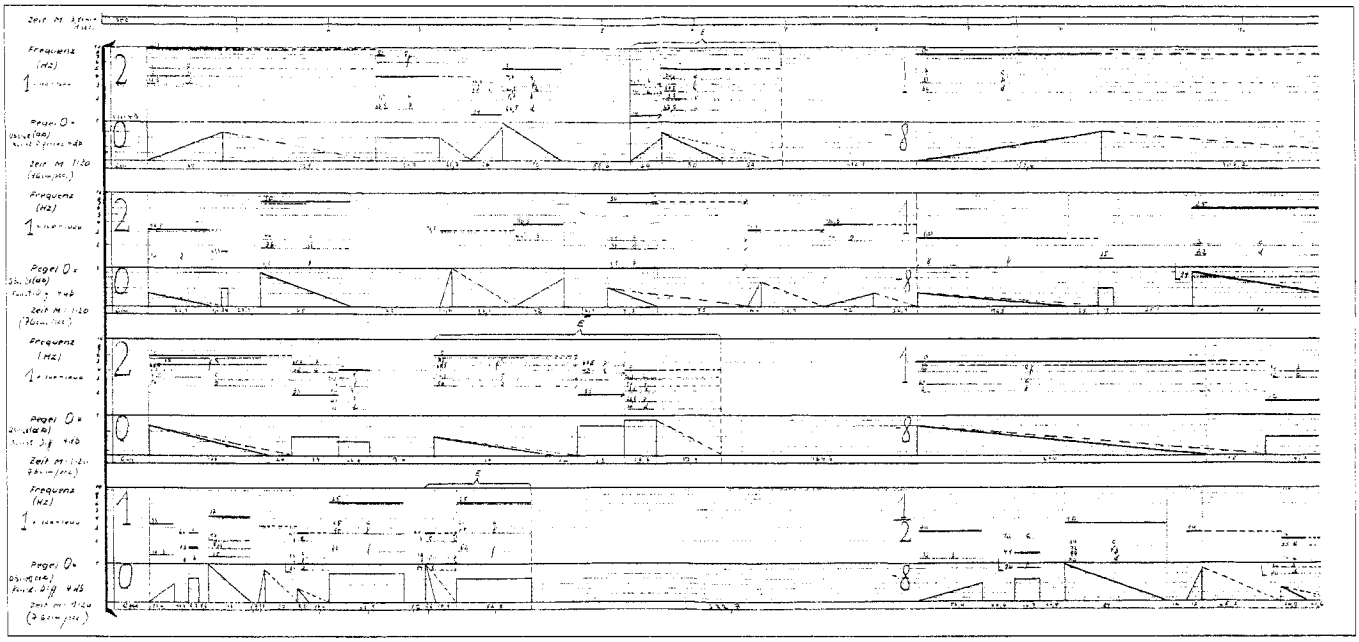
If you send me your agreement, I can then send you a jpeg file of the beginning of STUDIE I score

Mit herzlichem Gruß

Kathinka Pasveer
fuer den Stockhausen-Verlag
Kettenberg 15
51515 Kuerten
Germany
Fax 02268-1813
www.stockhausen.org

Am 8. Apr 2006 um 19:06 schrieb David Trustman:

> I sent an email on April 4th stating my need for copyright use approval:
>
> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including an image from Studie I found on the following website:
>
> http://www.medienkunstnetz.de/kuenstler/stockhausen/biografie/
>
> I would like your permission to do so.
>
> I need the approval for use of the image by Friday, April 14th. I hope that you can accommodate my request by that time and understand your office may be to busy to handle the request in such a short time. If I do not receive the approval in time, I will remove the image from the thesis before submitting it to the university.
>
> Thank you for your time,
>
> David Trustman



Moog

From: "Roger Luther" <rluther@moogarchives.com>
Subject: **Re: Pictures**
Date: April 4, 2006 7:20:45 PM PDT
To: "David Trustman" <david@donnercruz.com>
Reply-To: "Roger Luther" <rluther@moogarchives.com>

Hello David,

Thanks for asking. Yes, you may use pictures from MoogArchives.com for your thesis. I would just ask that you give credit with each picture such as "Photo courtesy of MoogArchives.com".

Let me know if you have any questions, and good luck with your thesis!

Roger
http://MoogArchives.com

----- Original Message -----
From: David Trustman
To: rl@moogarchives.com
Sent: Tuesday, April 04, 2006 9:31 PM
Subject: Pictures

I am writing a thesis on music technology for my graduate degree at San Jose State University and am including some Moog picture from your website in the thesis. Specifically, the opening picture of Bob Moog with his instruments and a minimoog shot. I would like your permission to do so.

Thank you,

David Trustman

Yamaha CP70

From: <mikebhsd1@earthlink.net>
Subject: **Re: copyright**
Date: April 4, 2006 6:55:27 PM PDT
To: "David Trustman" <david@donnercruz.com>

Hi David,

You have permission. Thanks for asking and good luck with your project.

Mike Braithwaite

> ----- Original Message -----
> **From:** David Trustman
> **To:** MB@cathedralstone.net
> **Sent:** Tuesday, April 04, 2006 6:52 PM
> **Subject:** copyright
>
> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including Yamaha CP70 picture from your website in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

Zendrum

From: "Zendrum" <info-zendrum@zendrum.com>
Subject: **RE: Copyright**
Date: April 4, 2006 4:22:54 PM PDT
To: "'David Trustman'" <david@donnercruz.com>
Reply-To: <info@zendrum.com>

Hey David,
That should be fine.
Just call it what it is- a MIDI controller.
Hope you get the result you want.
Best wishes,
David Haney
Inventor and co-founder
Zendrum Corp.

{Zendrum? Go to www.zendrum.com}

From: David Trustman [mailto:david@donnercruz.com]
Sent: Tuesday, April 04, 2006 7:06 PM
To: info@zendrum.com
Subject: Copyright

> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including a Zendrum picture from your website in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

Musictheory.net

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Good-Ear.com

From: "Martin Schoeberl" <martin@good-ear.com>
Subject: **Re: Copyright**
Date: April 5, 2006 12:06:54 AM PDT
To: "David Trustman" <david@donnercruz.com>

Hi David,

yes, you get the permission to do so. Thank's for asking.
When your thesis is finished can you drop me a note. I would
be interested to read it.

Cheers,
Martin
----- Original Message ----- From: "David Trustman" <david@donnercruz.com>
To: <martin@good-ear.com>
Sent: Wednesday, April 05, 2006 12:48 AM
Subject: Copyright

> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including some of the screen shots from Good-Ear.com in the thesis. I would like your permission to do so.
> Thank you,
> David Trustman

Dolphin Don's Music School

From: "Don Bowyer" <bowyerd@uah.edu>
Subject: **RE: Copyright Info**
Date: April 5, 2006 6:25:41 AM PDT
To: "'David Trustman'" <david@donnercruz.com>

You have my permission. I would also be very interested in seeing your final thesis, as I continue to teach music technology.

Sincerely,
Don Bowyer
Dolphin Don's Music School
256-658-2537
ddon@dolphindon.com

Don Bowyer, D.A.
Chair, Department of Music
University of Alabama in Huntsville
256-824-2582
bowyerd@uah.edu

-----Original Message-----
From: David Trustman [mailto:david@donnercruz.com]
Sent: Tuesday, April 04, 2006 5:29 PM
To: ddon@dolphindon.com
Subject: Copyright Info

Don,

I am a graduate student at San Jose State University. I am writing a thesis on music technology and have a used some of the screen shots from your web site in the thesis. I wanted to ask your permission to use the shots before I turn in the thesis.

Thank you,

David Trustman

Digital Performer

From: Nic Tuttle <Nic_Tuttle@motu.com>
Subject: **MOTU Digital Performer Screenshot Usage**
Date: April 5, 2006 6:48:51 AM PDT
To: david@donnercruz.com

David,

I am writing with regards to your inquiry about the usage of screenshots of our software in an academic thesis.
Visual reproductions of our the various windows of our Digital Performer audio sequencing software may be used without copyright violation.

Please let me know if you need further clarification or assistance.

Nic Tuttle
==========
MOTU Customer Service
1280 Massachusetts Avenue
Cambridge, MA 02138
P: (617) 576 2760 9am - 6pm EST
F: (617) 576 3609
W: www.motu.com

Band-in-a-Box

From: "PG Music Marketing" <marketing@pgmusic.com>
Subject: **Re: Copyright**
Date: April 5, 2006 7:40:55 AM PDT
To: "David Trustman" <david@donnercruz.com>
Reply-To: "PG Music Marketing" <mlemna@pgmusic.com>

Hi David,

Thanks for your note.

Yes, that would be fine. Please ensure that you properly credit both PG Music Inc. and Band-in-a-Box for the shots. Although I am confident you will.

Best Regards,
Mark Lemna
PG Music Inc.

----- Original Message ----- From: "David Trustman" <david@donnercruz.com>
To: <marketing@pgmusic.com>
Sent: Tuesday, April 04, 2006 3:38 PM
Subject: Copyright

> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including some of the screen shots from Band-in-a-Box in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

Music Ace

From: "Skip Nesbit-Harmonic Vision" <skip@harmonicvision.com>
Subject:
Date: April 5, 2006 7:51:21 AM PDT
To: <david@donnercruz.com>

Hi David,

Thank you for your recent inquiry seeking permission to include Music Ace screen shots in your San Jose State Masters thesis. I thought that I would respond via email so that you have a written record.

Yes, you may include Music Ace screen shots in your thesis.

We also have a request for you...

Please send us a copy of your thesis. We are always interested in reviews and comments about music technology in general and our products in particular. You may email a copy to sales@harmonicvision.com or USPS mail it to the address listed below.

Thank you for your interest in the Music Ace education software series. If you have any questions, please let me know; I'm happy to help.

Regards,

Skip Nesbit

Harmonic Vision Sales
155 North Wacker Drive, suite 725
Chicago, IL 60606
email: sales@harmonicvision.com
phone: (312) 224-2923 or 800-474-0903 x2923
toll-free order fax line: (866) 422-6686

Emusictheory.com

From: "eMusicTheory.com" <feedback@emusictheory.com>
Subject: **Re: contact (general)**
Date: April 4, 2006 4:20:33 PM PDT
To: "david@donnercruz.com" <david@donnercruz.com>

No problem; permission granted. Could I possibly get a copy of the finished thesis when you're done?

Regards,
Rob Whelan
eMusicTheory.com

david@donnercruz.com wrote:

> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including some of the screen shots from eMusictheory.com in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

Big Ears

From: Michael Ossmann <mike@ossmann.com>
Subject: **Re: Copyright**
Date: April 6, 2006 10:29:27 AM PDT
To: David Trustman <david@donnercruz.com>
1 Attachment, 0.2 KB Save

Please feel free. I'd love to see a copy of the finished producte.

Mike

On Tue, Apr 04, 2006 at 03:50:10PM -0700, David Trustman wrote:

> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including some of the screen shots from Big Ears in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

Emedia Guitar

From: "Dave Kurtiak, Emedia" <davek@emediamusic.com>
Subject: **Re: copyright**
Date: April 4, 2006 3:46:15 PM PDT
To: David Trustman <david@donnercruz.com>
Reply-To: davek@emediamusic.com
1 Attachment, 0.4 KB Save

David,
You have permission to use screen shots from our Guitar Method CD-ROM in your thesis.
Regards,
Dave Kurtiak
eMedia Music

Download the new /2006 eMedia Music Catalog/: http://emediamusic.com/catalog/Catalog.pdf

David Trustman wrote:

> Hi Dave,
>
> As per our conversation, I am writing a thesis on music technology for my graduate degree at San Jose State University and am including some of the screen shots from Guitar Method in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

davek.vcf (0.4 KB)

Clearvue

From: "Kelli Campbell" <kcampbell@clearvue.com>
Subject: **Re: Copyright**
Date: April 4, 2006 3:47:22 PM PDT
To: "David Trustman" <david@donnercruz.com>

David,

You have our permission to use screen grabs from the CLEARVUE Art & Music CD-ROMs for use in your thesis. We do not hold the copyright to Switched on Sound. I believe this is owned by Duke University. You'll want to contact them.

Best regards,

Kelli Campbell
Vice President, Marketing & Product Development
CLEARVUE & SVE
6465 North Avondale Avenue
Chicago, IL 60631
www.clearvue.com www.PowerMediaPlus.com
773-775-9433 ext. 208

----- Original Message ----- From: "David Trustman" <david@donnercruz.com>
To: <kcampbell@clearvue.com>
Sent: Tuesday, April 04, 2006 5:43 PM
Subject: Copyright

> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including some of the screen shots from Switched on Sound and Art & Music CD's in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

Practica Musica

From: Jeff Evans <jevans@ars-nova.com>
Subject: **Re: Copyright**
Date: April 4, 2006 4:19:56 PM PDT
To: David Trustman <david@donnercruz.com>

Dear Mr. Trustman,

You have our permission to use screen shots from Practica Musica in your thesis, and good luck to you in your career.

Yours, Jeff Evans
Ars Nova Software

> I am writing a thesis on music technology for my graduate degree at San Jose State University and am including some of the screen shots from Practica Musica in the thesis. I would like your permission to do so.
>
> Thank you,
>
> David Trustman

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GarageBand

From: Copyright Agent <copyrightagent@apple.com>
Subject: **Screen Shot Guidelines**
Date: April 6, 2006 11:47:10 AM PDT
To: <david@donnercruz.com>
1 Attachment, 88.2 KB Save

Please see enclosed.

copyrightagent@apple.com

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Date: April 4, 2006 3:32:28 PM PDT
To: <David@donnercruz.com>
Reply-To: <pmaund@sibelius.com>
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April 4, 2006

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Sincerely,

Peter Maund
Director, Business Development
Sibelius USA, Inc.
1407 Oakland Blvd. Suite 103
Walnut Creek, CA 94596
Tel. 925.280.0600
Fax 925.280.0008
www.sibelius.com
pmaund@sibelius.com

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Finale

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AGREED

MAKEMUSIC, INC.

By: Julie R. Sopoci

Name: Julie R. Sopoci

Title: Manager, Repertoire Development

Date: February 3, 2006

By: _____

Name: David A. Trustman

Title: _____

Date: April 3, 2006

YAMAHA CORPORATION OF AMERICA

6600 Orangethorpe Avenue, P.O. Box 6600, Buena Park, CA 90622-6600 (714) 522-9011

April 7, 2006

DAVID TRUSTMAN
890 Calabasas Road
Watsonville, California 95076

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By: Brian J. Jemelian, Corporate Vice President

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DAVID TRUSTMAN

By: _____
Title: _____